

RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

PUBLISHED BY THE RADIOLOGICAL SOCIETY OF NORTH AMERICA

VOL. XVII

AUGUST, 1931

No. 2

PRIMARY CARCINOMA OF THE FEMALE EXTERNAL GENITO- URINARY ORGANS TREATED WITH RADIUM AND ROENTGEN RAYS¹

By HARRY H. BOWING, M.D.

Section on Therapeutic Radiology, The Mayo Clinic, ROCHESTER, MINNESOTA

IT is not uncommon to see a brilliant local response to radium therapy of primary carcinomatous lesions of the female external genito-urinary organs. This observation prompted a review of the total number of these cases seen in the Section on Therapeutic Radiology of The Mayo Clinic. The study includes all patients with the conditions under consideration, who were treated from 1915 to 1929, inclusive, a total of 95. Radium therapy was first employed at The Mayo Clinic for carcinoma of the vulva in 1915.

Rentschler, of the Clinic, reported a similar study recently. In his review he included only cases seen on the surgical service between 1907 and 1927. The present report includes 38 cases studied by Rentschler. This number was referred to the Section on Therapeutic Radiology from the surgical service.

The incidence of carcinoma involving the external female genitalia has been recorded by various authors. Schwarz gave the incidence as 1.38; Virchow reported 1.35 or 1.40; Gurlt gave the incidence of 1.48; Taussig gave 1.20. Brady, reporting

statistics from Johns Hopkins Hospital, recorded 19 cases of epithelioma of the vulva and 756 cases of carcinoma of the cervix, or a ratio of 1.397. In two of the cases the growth was of the urethra. In The Mayo Clinic the ratio based on histologic study was 1.25. Clark and Norris reported that among 1,119 specimens of newgrowths in the Gynecologic Laboratory of the University of Pennsylvania there were 30 carcinomas of the vulva. There was a total of 1,049 carcinomas in the same laboratory; that is, carcinoma of the vulva represented 2.9 per cent of all gynecologic carcinomas there. Ewing stated that carcinomas of the vulva are not rare; they form 10 per cent, according to Gurlt, of all carcinomas in women.

The age incidence in the group on which this paper is based is almost identical to that reported by Rentschler (Table I). Sixty-six patients, or nearly 70 per cent, were between the ages of forty-five and sixty-nine years, the average age being 57.24 years. The youngest patient was thirty years of age and the oldest eighty-five years.

The civil state is recorded in Table II. The average number of pregnancies was four. The number of multiparæ in this

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, December 1-5, 1930.

TABLE I.—INCIDENCE BY AGE

Age, years	Cases	Per cent
30 to 34	5	5.26
35 to 39	5	5.26
40 to 44	5	5.26
45 to 49	11	11.57
50 to 54	15	15.78
55 to 59	13	13.68
60 to 64	15	15.78
65 to 69	12	12.63
70 to 74	7	7.36
75 to 79	4	4.21
80 to 84	2	2.10
85 to 89	1	1.05
Total	95	
Average age 57.24		

group was 17, or 19.10 per cent; the corresponding values given by Taussig and by Giesecke were 18 per cent and 43 per cent, respectively. Berkeley and Bonney, in a similar study, reported that 58.6 per cent were married; 25.8 per cent were widows, and 15.6 per cent were single women. Sterility occurred in 48.2 per cent of their cases, and the average number of pregnancies was seven.

The frequency with which various parts of the vulva are involved was found by Rothchild, who studied 395 carcinomas of the vulva, to be as follows: clitoris, 62; clitoris and labia of one side, 41; clitoris and labia of both sides, 21; labia majora, 105; labia minora, 35; labia majora and minora, 29; tissue about the urethra, 6; posterior commissure, 11, and Bartholin's gland, 17. Owing to the extent of the primary lesion when first seen by the surgeon and radiologist it is in many cases impossible to determine the exact site of the initial involvement; however, the situation of the primary tumors in the cases reviewed for this study is given in the last line of Table III. Ederle tabulated 677 carcinomas of the vulva and pointed out the marked predisposition of the clitoris to malignant change. This is especially noticeable when the small surface occupied by this structure is considered. In Ederle's series the clitoris was affected in

109 cases. In this study the cases recorded as occurring primarily in the tissues of the external urinary meatal region were included. Cabot stated that probably not more than twenty-five or thirty critically studied cases of primary carcinoma arising from the mucous membrane of the urethra have been reported. In many of the cases in this study infiltration was extensive when first seen. Therefore, the possibility of the tumor arising in the para-urethral ducts, in peri-urethral tissue, in the vagina, or in the bladder must be taken into account.

The first symptoms noticed by the patients can be grouped as follows: tumor was noted in 45 cases (47.36 per cent); ulcer, in 36 cases (37.89 per cent); discharge, in eight cases (8.42 per cent); urinary symptoms in three cases (3.15 per cent), and pain, in two cases, (2.10 per cent). In one case (1.05 per cent) the first symptom was not recorded.

In 52 cases it was possible to estimate the interval of time between the onset of the first symptom and the first visit to the physician. The shortest interval was one week; the longest interval was thirteen years; the average, about eighteen months.

Pruritus was the most common associated local condition; it was recorded in 37 cases (38.94 per cent). Ewing expressed the opinion that the associated parakeratosis and infiltration of the corium with round cells in pruritus are distinctly favorable to the development of epitheliomatous lesions of the vulva. At times the itching is intense. Scratching may result in repeated trauma, and in some cases repeated or chronic irritation is a factor in the development of malignant disease. Berkeley and Bonney reported that 36 per cent of their patients who had carcinoma complained of pruritus. Associated systemic disease was not common in this group. One case each of diabetes, syphilis, and nephritis occurred, or a percentage of 1.05 each. Berkeley and

TABLE II.—INCIDENCE OF PREGNANCY

Civil state	Cases	Per cent	Pregnancies											None	Not recorded
			1	2	3	4	5	6	7	8	9	10	11		
Married	91	95.78	14	16	7	10	7	5	4	3	3	1	2	17	2
Single	4	4.21												4	
Total	95	99.99	14	16	7	10	7	5	4	3	3	1	2	21	2

TABLE III.—GRADE OF LESION IN RELATION TO ITS SITUATION

Microscopic diagnosis	Cases	Labia majora		Labia minora		Urethra		Clitoris		Vestibule		Bartholin gland	
		Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
Epithelioma not graded	1					1	6.25						
Squamous-cell epithelioma, graded 1	3	2	4.54			1	6.25						
Squamous-cell epithelioma, graded 2	28	19	43.18	2	100	4	25.00	3	75				
Squamous-cell epithelioma, graded 3	19	13	29.54			5	31.25	1	25				
Squamous-cell epithelioma, graded 4	11	7	15.90			4	25.00						
Basal-cell epithelioma	1	1	2.27										
Adenocarcinoma, graded 2	2	1*	2.27									1	100
Inflammatory tissue	2	1	2.27			1	6.25						
No biopsy	28	19	30.15			8	33.33			1	100		
Total	95	63	66.31	2	2.10	24	25.26	4	4.21	1	1.05	1	1.05

*Papillary adenocarcinoma graded 2 in a cyst.

Bonney, in reporting 58 cases of carcinoma of the vulva, and 19 of leukoplakic vulvitis, among patients admitted to the Middlesex Hospital and Chelsea Hospital for Women in the last ten years, stated that in none of their cases was there any history or sign of antecedent syphilis, nor could evidence of the presence of the *Treponema pallidum* be obtained by histologic methods. Graves has expressed the opinion that leukoplakia and kraurosis (white vulvitis) invariably result from chronic irritation, that they represent the result of an irritating process, and that carcinoma of the vulva is a good illustration of the relationship between irritation and malignant neoplasia.

MacKee has stated that leukoplakia is a dangerous pre-epitheliomatous lesion. Taussig holds that leukoplakic vulvitis is undoubtedly the most frequently encountered causal factor of carcinoma of the vulva. He

states further that there are other conditions to be reckoned with, such as syphilis, acuminate warts, and trauma. In a series of 23 cases which he saw, syphilis occurred in two, trauma in two, condyloma acuminatum in one, leukoplakic vulvitis in fourteen, and accompanying lesions of uncertain nature in four. He expressed his feeling that this incidence justifies the classification of leukoplakia as a precancerous lesion. Further on in the chapter on carcinoma of the vulva, he mentioned that Perruchet found three cases out of 19 in which leukoplakia had not progressed to the stage of carcinoma, and he concluded, as also did Petit, that the leukoplakia is just the first stage of carcinoma and that sooner or later in every case in which this form of vulvitis has occurred, carcinoma is certain to develop. In commenting on these conclusions, Taussig did not care to hold to such all-inclusive

statements. In a later study he reported 39 cases of a total of 76 (51.31 per cent) in which leukoplakic vulvitis occurred. Berkeley and Bonney, in their review, previously referred to, gave their opinion that leukoplakic vulvitis is an antecedent condition and the cause of carcinoma of the vulva. In their cases of carcinoma of the vulva that came to operation, as well as every case seen, leukoplakic vulvitis has always been present.

Taussig stated that simple kraurosis of the vulva is a chronic, atrophic condition, resulting in stenosis of the vaginal orifice, and that its lesions do not tend to undergo malignant degeneration; however, leukoplakic vulvitis with sclerosis, so-called leukoplakic kraurosis or kraurosis of Breisky, does occur as an etiologic factor in malignant disease of the vulva. Berkeley and Bonney wrote that they did not know of an instance in which kraurosis vulvæ had been associated with carcinoma of the vulva, and that in their opinion the two diseases are not related; in this way kraurosis vulvæ markedly differs from leukoplakic vulvitis. Taussig agreed with these authors that non-leukoplakic, or simple, kraurosis, is not associated with carcinoma of the vulva. Counsellor, in a recent paper, concluded that the relation of leukoplakia vulvitis to carcinoma is not definitely known and will be solved only when the cause of carcinoma is discovered.

It seems evident that, although these lesions are superficial and benign, they tend to malignant degeneration or change. Therefore, patients must be carefully observed at repeated intervals in order that radical surgical intervention may be instituted as soon as early changes have taken place. Locally applied medication, radium therapy, or roentgen therapy relieves the itching, and in some cases the leukoplakic vulvitis has been favorably influenced by radium or roentgen rays. However, MacKee has given the opinion that extensive leukoplakia is almost incurable by any method of treatment.

TABLE IV.—SIZE OF LESION IN RELATION TO CLASSIFICATION OF SEVERITY OF CASE

Classification	Large		Medium		Small	
	Cases	Per cent	Cases	Per cent	Cases	Per cent
Advanced	47	49.47	31	65.95	10	21.27
Modified	29	30.52	20	68.96	3	10.34
Borderline	4	4.21	2	50.00	1	25.00
Recurring	7	7.36			3	42.85
Early	8	8.42	1	12.50	1	12.50
Total	95		54	56.84	18	18.94

Advanced: Small, medium, or large lesion with enlarged nodes (grossly or microscopically).

Modified: Previous treatment affecting lesion elsewhere.

Borderline: Small, medium, or large lesion without enlargement of nodes.

Recurring: Previous operation affecting lesion at The Mayo Clinic.

Early: Small lesion without nodal enlargement.

Resection of the internal pudic nerve under local anesthesia relieves the itching or the cause of the repeated scratching, a source of chronic irritation. Vulvectomy, as stated by Miller, is both prophylactic and curative.

In this review of 95 cases, leukoplakia was found to be recorded in five cases (Rentschler in his review of 71 cases reported five cases); kraurosis, in ten cases, and keratosis, in two cases. I feel reasonably certain these data are incomplete, and that in all likelihood the ten cases just mentioned (kraurosis) could be grouped as cases of leukoplakic vulvitis with sclerosis. In many of the advanced cases, leukoplakia may have been present but not recorded.

From a clinical standpoint there are two types of primary carcinoma of the vulva: (1) the everted, fungating, papillary or medullary, and in some cases nodular, and (2) the inverted, infiltrating, or plaque-like lesions. In the advanced stages both types can be ulcerated, craters can be formed, and neighboring tissues can be undermined; usually these advanced lesions are associated with marked secondary infection. The growths are often multiple and apparently

are transmitted by contact from the labia of one side to those of the other. Graves has stated that the diagnosis from inspection may be either simple or difficult. A papillary or ulcerated lesion situated on a leukoplakic or sclerotic base is almost always a carcinoma or a precancerous growth. In different stages the appearance of the lesions resembles that in numerous diseases, such as lupus, condyloma, esthiomene, elephantiasis, granuloma inguinale, and metastatic carcinomatous processes; however, the diagnosis is readily made by biopsy. The cases included in this study were grouped into five classes: advanced, modified, borderline, recurring, and early; the percentages of each are given in Table IV. They could also be grouped according to the size of the primary lesion, together with notation as to whether or not there was inguinal nodular enlargement or involvement. When the primary region of involvement measured less than 2 cm., it was considered small; if it measured more than 2 cm. but not more than 4 cm., it was grouped as medium, and if it was larger than 4 cm., it was grouped as large.

The size only of the primary lesion does not determine its classification as advanced, modified, borderline, or recurring. For example (Table IV) in the advanced group, 31 cases (65.95 per cent) were large lesions; ten (21.27 per cent) were lesions of medium size, and six (12.76 per cent) were small lesions. In the modified group the percentage of large lesions was about the same as in the advanced group but the percentages of medium and small lesions were reversed. The numbers of borderline, recurring, and early lesions may be too small for comparison. In the recurring cases, the lesions were either medium or small, probably because the patients understood only too well the significance of delay as soon as it was evident that the tumor had returned. In six cases (75 per cent), the early lesions were

small. More than half of the total number of patients, when first seen at The Mayo Clinic, had large primary lesions: in 18 (18.94 per cent) of the cases the lesions were medium, and in 23 (24.21 per cent), they were small.

The size of the primary lesion, as well as the duration of the disease and the type of pathologic change, influences the regional and distant metastatic involvement. In Rentschler's thesis is a brief sketch of the anatomy of the lymphatic structures of the vulva. Rentschler gave a summary of Crossen's views as follows:

(1) From carcinoma of the labia majora or minora all the lymphatic distribution in the early stages is likely to be to the inguinal nodes; (2) this distribution may extend not only to the side on which the lesion is situated but also to the opposite side; hence the nodes on both sides should be removed, and (3) in carcinoma of the clitoris early distribution to the glands inside the pelvis is probable.

In the cases with ulcerated lesions there is a possibility that the inguinal nodal enlargement may be due to the ulceration or secondary infection.

Schwarz found that the swollen inguinal nodes were invaded by carcinoma in only about half of his cases, and Dittrich stated that involvement of the lymph nodes occurs in about 50 per cent of the cases in the second six months of the disease. Evidently these tumors metastasize rapidly. The cases which form the basis of the present review do not furnish positive data in this regard; however, there were 17 cases in which abnormal nodal conditions were proved clinically and by examination of tissues (Table V). The incidence of clinically proved nodal enlargement in the 95 cases is given in the same table. It shows rather clearly that any method of treatment that did not take into account the inguinal nodu-

TABLE V.—CONDITION OF LYMPH NODES

Condition		Bilateral enlargement of inguinal nodes		Unilateral enlargement of inguinal nodes		Nodes not enlarged		Size of nodes not recorded		Total	
		Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent
By pathologic methods	Positive	3		4		2		1		10	
	Negative	1		1		1		4		7	
Clinically positive		44	46.31	16	16.84	15	15.78	20	21.05	95	99.99

TABLE VI.—TYPE OF TREATMENT IN RELATION TO SIZE OF LESION*

Size of lesion, cm.	Cases	Excision of growth and								Radium and roentgen rays		Radium	
		Removal of inguinal nodes, radium and roentgen ray		Removal of inguinal nodes and radium		Radium and roentgen rays		Radium					
		Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent		
Less than 2	23	2	8.69	2	8.69	3	13.04	7	30.43	2	8.69	7	30.43
2 to 4	18	4	22.22	3	16.16	1	5.55	2	11.11	4	22.22	4	22.22
More than 4	54	4	7.40	2	3.70	3	5.55	9	16.66	17	31.48	19	35.18
Total	95	10	10.52	7	7.36	7	7.36	18	18.94	23	24.21	30	31.57

*11 cases (11.57 per cent), no post-operative treatment to the primary lesion.

45 cases (47.36 per cent), no treatment to the secondary lesion.

lar regions would be decidedly inadequate.

Of the total of 67 tumors that were studied microscopically, 62 (92.53 per cent) were squamous-cell epitheliomas. Broders graded 61: 31 were graded 1 or 2 and 30 were graded 3 or 4. In this group, the number of neoplasms of low to moderately high grade of malignancy and the number of neoplasms of rather high grade of malignancy may be considered equally distributed. The grades of the lesions, in relation to their situation, is given in Table III, which has been referred to before.

The cases were grouped in six classes according to the method of treatment. The headings in Tables VI, VII, and VIII describe the type of operation employed. Vulvectomy was not listed; however, one operation was described as excision of the labia and part of the vagina. In three cases an operation in two stages was done; the

primary lesion was excised and at a later date the inguinal nodes were removed. All other operations in this study were performed in one stage. Surgical diathermy was resorted to in four cases. Of late years this has not been used; however, its merit should be known, since in selected cases it is a rapid method of freeing the field of the primary tumor of necrotic material. These wounds are usually painless, and local healing is rather prompt. Table VI also furnishes data as to the number and percentage of small, medium, and large primary lesions treated by different methods. The table further shows that the majority of the large lesions were treated by radium and roentgen rays or by radium only.

The time of the irradiation was divided into three classifications, as follows: five patients (5.25 per cent) received treatment before operation; post-operative treatment

TABLE VII.—TYPE OF TREATMENT IN RELATION TO GRADE OF PATHOLOGIC LESION

Microscopic diagnosis			Excision of growth and											
			Removal of inguinal nodes, radium and roentgen ray		Removal of inguinal nodes and radium		Radium and roentgen rays		Radium					
			Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent				
	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent	Cases	Per cent		
Squamous-cell epithelioma not graded	1	1.49											1	100.00
Squamous-cell epithelioma, graded 1	3	4.47	1	33.33			1	33.33					1	33.33
Squamous-cell epithelioma, graded 2	28	41.79	4	14.28	3	10.71	3	10.71	12	42.85	2	7.15	4	14.28
Squamous-cell epithelioma, graded 3	19	28.35	3	15.78	1	5.26	3	15.78	3	15.78	5	26.31	4	21.05
Squamous-cell epithelioma, graded 4	11	16.41	2	18.18	3	27.27							2	18.18
Adenocarcinoma, graded 2	2	2.98							2	100.00				
Basal-cell epithelioma	1	1.49							1	100.00				
Inflammatory tissue	2	2.98									1	50.00	1	50.00
No biopsy	28	29.47									12	42.85	16	57.14
Total	95		10	10.52	7	7.36	7	7.36	18	18.94	23	24.21	30	31.57

was applied in 37 cases (38.94 per cent); 53 patients (55.78 per cent) were not operated on.

The type of the treatment considered here has been described in another article (3), and the study revealed that 54 patients (56.84 per cent) received complete treatment, 23 (24.21 per cent) received prophylactic treatment, and 18 (18.94 per cent) received only limited treatment. In none of the cases was the treatment abandoned. The type of treatment has always been influenced by the extent of the local and distant involvement, general condition of the patient, and so forth.

Of late years more cases were referred to the Section on Therapeutic Radiology without surgical intervention. Table VIII shows to what extent this shift to irradiation has occurred. The headings are the same as those used in Table VI. The patients were grouped according to the year of their initial treatment. More than half (53) of the patients were treated either with radium only or with radium combined with roentgen rays. The table also shows that irradiation, even in early years, was thought

worthy of consideration in the treatment of these lesions, and as time passed the effectiveness was more apparent and wider use was made of it.

It was considered of interest to determine, if possible, if the grade of malignancy influenced the type of treatment. The same headings as those used in Table VI were used in Table VII. Since the tumors which were graded were about equally distributed between Grades 1 and 2 on the one hand, and Grades 3 and 4 on the other, it seems reasonable to assume that in the 28 cases (29.47 per cent) in which material was not available for grading and in which treatment was by irradiation only, the number of patients with high and with low grades of malignancy, respectively, would have been approximately equal. It seems rather evident that the grade of malignancy did not influence the type of treatment. However, in a general way I am confident that the members of the surgical staff at The Mayo Clinic fully appreciate the ultimately poor prognosis in cases graded 3 and 4, when operation only is employed.

TABLE VIII.—TYPE OF TREATMENT IN RELATION TO YEAR TREATMENT GIVEN

Year	Cases	Excision of growth and					
		Removal of inguinal nodes, radium and roentgen ray	Removal of inguinal nodes and radium	Radium and roentgen rays	Radium	Radium and roentgen rays	Radium
1915	2				1		1
1916	2	1			1		
1917	6	1	3		2		
1918	11	2	1		2	3	3
1919	13	1	2	1	1	5	3
1920	8	2		2		3	1
1921	7	1			1	2	3
1922	2				1	1	
1923	10		1		1	2	6
1924	5			3	1		1
1925	5				3	1	1
1926	7				1	3	3
1927	5				2	2	1
1928	3	1				1	1
1929	9	1		1	1		6
Total	95	10	7	7	18	23	30

Full description of the technic employed in radium therapy will be omitted; however, the type of applicators employed was determined and is recorded in Table IX. The universal silver tube containing 50 mg. radium sulphate (element) was the applicator most frequently used in treating the primary lesion. It was usually screened with 1.0 mm. brass and 2.0 mm. rubber. When distance was interposed balsa wood or dental mold was used. The monel needles contained 10 or 5 mg. radium sulphate (element) and the rays were filtered only through their walls, which were 0.4 mm. thick. Platinum-iridium (walls 0.4 mm.) needles containing 1.0 mg. of radium sulphate (element) were also used with gratifying local results. In only one case in this group were glass seeds or implants employed; this was in 1922.

The universal silver tube was also the applicator of choice in treating the secondary lesions. In cases in which the lesion was ul-

TABLE IX.—METHOD OF APPLICATION OF RADIUM

	Primary lesion		Secondary lesion	
	Cases	Per cent	Cases	Per cent
Tubes	47	55.95	7	14
Needles	10	11.90	1	2
Plaques	9	10.71		
Seeds	1	1.19		
Surface packs	7	8.33	42	84
Tubes and needles	7	8.33		
Tubes and plaques	1	1.19		
Needles, tubes and plaques	1	1.19		
Tubes and surface packs	1	1.19		
Total	84	88.42	50	52.63

cerated, the tubes were usually placed in contact with the surface. In this event I prefer to use tubes containing about 20 millicuries of radon; in this way the time of application is lengthened. The surface pack, previously described (4), was the most popular method in treating the secondary lesions. Effective treatment is difficult and tedious to apply. It is decidedly important to have available a variety of applicators in order to insure employment of the proper technic in a given case. The situation of the lesion and the fact that function of the part is necessary, either during the time of treatment or in the convalescent period after treatment, makes it almost impossible to put the part at rest. Adequate treatment is essential, and yet every endeavor must be made to avoid overtreatment and the resulting radionecrosis and pain. It is also essential to avoid injury of neighboring tissues, such as erythema, in adjacent cutaneous surfaces. These cases tax the ingenuity of the radium therapist in designing, fitting, and maintaining applicators in position for the required time. The initial results are usually gratifying in that the primary lesion heals. However, the metastatic processes are usually only arrested, chiefly because efficient treatment cannot be applied. For treatment of involvement of the inguinal lymph nodes alternative to radium,

TABLE X.—GRADE OF NEOPLASMS IN RELATION TO SURVIVAL OF PATIENTS

Range of years following treatment	Cases with definite information														Patients living at the end of the period specified in the first column				
	Cases	No biopsy	Inflammatory	Epithelioma							Basal-cell epithelioma	Adenocarcinoma graded 2	Died		Lost track of		Patients whose experience does not continue into following year		Patients whose experience continues into following year
				Not graded	Grade 1	Grade 2	Grade 3	Grade 4	Patients	Per cent of total deaths			Patients	Per cent of total lost track of	Cases	Per cent of total living			
0 to 1	79	18	1	1	3	25	18	10	1	2	26	49	4	36			49		
1 to 2	49	7	1		3	17	11	7	1	2	16	30	1	9	3	20	29		
2 to 3	29	2	1		3	13	4	4	1	1	6	11	3	27			20		
3 to 4	20	1			3	8	4	2	1	1	1	2			1	6.66	18		
4 to 5	18	1			3	8	3	1	1	1	2	4			2	13.33	14		
5 to 6	14	1			2	5	3	1	1	1	2	4					12		
6 to 7	12	1			1	5	3	1		1			1	9	1	6.66	10		
7 to 8	10	1			1	4	3	1							2	13.33	8		
8 to 9	8	1			1	4	2										8		
9 to 10	8	1			1	4	2						2	18	2	13.33	4		
10 to 11	4				1	3									1	6.66	3		
11 to 12	3				1	2									1	6.66	2		
12 to 13	2					2											2		
13 to 14	2					2									1	6.66	1		
14 to 15	1					1											1		
15 to 16	1					1									1	6.66			
Total	79*										53		11		15				
Per cent of total dead and living (68)											77.94		13.92**		22.05				

*Total number of cases at start of study.

**Percentage of total number of cases (79).

moderate voltage roentgen therapy (18) may be given over the inguinal regions employing multiple fields, and so-called high voltage roentgen therapy may be given over a large posterior field. However, for treatment of secondary involvement of the pelvis, high voltage roentgen therapy is the method of choice, and may be given through anterior and posterior portals.

The grade of neoplasm in relation to survival of patients, as well as the late results in all cases concerning which definite information is available, is given in Table X. The table shows that the ultimate prognosis in cases in which lesions are of Grade 3 or 4 is more grave than in those in which

lesions are of Grade 1 or 2. More proof will be offered when Table XI is considered.

Concerning 79 of the 95 cases in the series definite or complete information was available. The growths in 60 of these 79 cases were proved microscopically to be malignant, and in 19 cases they appeared on macroscopic examination to be malignant. In the first year 26 patients died (49 per cent of the total number of those who died) and four patients (36 per cent of the total) were not traced. Therefore, at the end of the first period specified in the left-hand column of Table X, 49 patients were remaining whose experience continues into the second range of years. This will illustrate the

TABLE XI.—GRADE OF EPITHELIOMA IN RELATION TO NUMBER OF PATIENTS WHO HAVE LIVED VARIOUS NUMBERS OF YEARS

Range of years following treatment	Epithelioma Grades 1 and 2						Epithelioma Grades 3 and 4					
	(A) Total cases	(B) Died	Lost track of	Patients living at the end of the period specified in the first column			(A) Total cases	(B) Died	Lost track of	Patients living at the end of the period specified in the first column		
				Patients whose experience does not continue into following year	Patients whose experience continues into following year					Patients whose experience does not continue into following year	Patients whose experience continues into following year	
0 to 1	28	7	1	0	20		28	10	0	0	18	
1 to 2	20	3	1	0	16		18	7	0	2	8	
2 to 3	16	4	1	0	11		8	2	0	0	6	
3 to 4	11	0	0	0	11		6	1	0	1	4	
4 to 5	11	2	0	2	7		4	0	0	0	4	
5 to 6	7	1	0	0	6		4	0	0	0	4	
6 to 7	6	0	1	0	5		4	0	0	0	4	
7 to 8	5	0	0	0	5		4	0	0	2	2	
8 to 9	5	0	0	0	5		2	0	0	0	2	
9 to 10	5	0	1	0	4		2	0	1	1	0	
10 to 11	4	0	0	1	3							
11 to 12	3	0	0	1	2							
12 to 13	2	0	0	0	2							
13 to 14	2	0	0	1	1							
14 to 15	1	0	0	0	1							
15 to 16	1	0	0	1	0							
Death rate per year 13.32 ± 2.03 per cent*							Death rate per year 26.25 ± 3.32 per cent					
Difference between death rates = 12.93 ± 3.89 per cent												

$$\text{*Death rate per cent} = \frac{\text{total (of Column B)}}{\text{total (of Column A)}} \quad 100 = \frac{\text{total deaths}}{\text{total number of experience years}} \quad 100$$

way to interpret Table X. The cases in which the growths were assumed by macroscopic examination to be malignant can be determined in each horizontal line by adding the quantity in the column headed "no biopsy" and the quantity in the column headed "inflammatory." The horizontal sum of the quantities in the next seven columns to the right will give the number of cases in which the malignancy was determined by microscopic examination. The assumption that the clinical diagnosis of carcinoma of the vulva in this group was correct seems justified, since only seven of the 18 patients in whose cases clinical evidence was relied on

for diagnosis, entered the second period of experience, and only two entered the third period. Often, owing to extensive involvement, associated secondary infection, and concomitant general poor health of the patient, material for biopsy is not obtained.

As a final analysis of the 79 cases observed during this period of sixteen years, 53 patients (77.94 per cent) of the 68 who could be treated are dead, and 15 (22.05 per cent) are known to be living. I have lost track of eleven patients (13.92 per cent) of the total number of cases at the start of the study. It is generally accepted that Broders' method of grading epitheliomatous neo-

plasms in a great measure furnishes ground for prognosis, and especially in groups of surgical cases.

Table XI shows the grade of epithelioma in relation to length of life in this group of 56 patients. The headings are similar to those in Table X and the analysis remains the same. It is evident that patients with lesions graded 1 and 2 live a greater number of years after treatment than those who have lesions graded 3 and 4. The calculated death rate² per year for patients with lesions graded 1 and 2 is 13.32 ± 2.03 per cent, whereas the death rate per year for patients with lesions graded 3 and 4 is 26.25 ± 3.32 per cent. Since these death rates have been established on only 127 and 180 years of experience, respectively, one wonders if the difference of 13 per cent between them is due to the higher grades of malignancy in one group or whether it is a difference that could arise by sampling. The difference is 12.93 ± 3.89 , or 3.3 times its probable error, which is equivalent to saying that the chances in favor of this being a difference due to something other than sampling are ninety-eight in a hundred. It is evident that the death rate per year for patients with lesions of high grade is double that of patients with lesions of low grade. The fact that the death rate is higher in cases of epithelioma in which the growth is graded 3 or 4 than in cases in which it is graded 1 or 2 furnishes new evidence that Broders' method of grading neoplasms is of value in prognosis.

Table XII records the death rate in percentage for patients with different grades of epithelioma. The table furnishes definite evidence that the grade of malignancy in-

TABLE XII.—DEATH RATES FOR GRADES OF EPITHELIOMA IN RELATION TO YEARS OF LIFE AFTER TREATMENT (LIFE YEARS OF EXPERIENCE)

Range of years following treatment	All cases with definite information			Epithelioma graded 1 and 2			Epithelioma graded 3 and 4		
	Life years of experience	Died	Death rate, per cent	Life years of experience	Died	Death rate, per cent	Life years of experience	Died	Death rate, per cent
0 to 1	79	26	32.9	28	7	25.0	28	10	35.7
0 to 2	128	42	32.8	48	10	20.8	46	18	39.1
0 to 3	157	48	30.6	64	14	21.9	54	20	37.0
0 to 4	177	49	27.7	75	14	18.7	60	21	35.0
0 to 5	195	51	26.1	86	16	18.6	64	21	32.8
0 to 6	209	53	25.3	93	17	18.3	68	21	30.9
0 to 7	221	53	24.0	99	17	17.2	72	21	29.2
0 to 8	231	53	22.9	104	17	16.3	76	21	27.6
0 to 9	239	53	22.2	109	17	15.6	78	21	26.9
0 to 10	247	53	21.4	114	17	14.9	80	21	26.2
0 to 11	251	53	21.1	118	17	14.4			
0 to 12	254	53	20.9	121	17	14.0			
0 to 13	256	53	20.7	123	17	13.8			
0 to 14	258	53	20.5	125	17	13.6			
0 to 15	259	53	20.5	126	17	13.5			
0 to 16	260	53	20.4	127	17	13.4			

fluences the percentage death rate in the respective groups; lesions graded 3 and 4 give the greatest percentage death rate. In the first column of the table is recorded the range or extent of years following treatment; in the second column all cases are grouped together. For the first year, seventy-nine life years of experience was accumulated by the group and 26 patients died, giving a death rate of 32.91 per cent. At the end of the fifth year, one hundred and ninety-five life years of experience had been accumulated by the group and 51 patients had died, giving a death rate of 26.15 per cent, and so on. In a similar way the lesions graded 1 and 2 and those graded 3 and 4 were considered and recorded. This table gives further evidence that the grade of malignancy encountered furnishes definite information concerning prognosis. These facts also enter into consideration of the best type of treatment to employ in a given case; that is, operation

²To-day certain words and phrases used in life insurance tables have found place in medical literature; for example, the word "risk" and the expression "life expectancy" have definite medical definitions. The term "life experience" as used in life insurance tables may be borrowed and as time passes may prove of value in estimating results obtained from treatment in terms of the death rate in certain diseases or in groups occurring in them. In this study, "life experience" is used to signify the total number of years of life of all individuals in a group taken together; "death rate per cent" signifies the total number of deaths per 100 experience years (this concept is applied in Tables XI and XII).

only, radium only, roentgen rays only, or any combination of operation, radium, and roentgen rays.

CONCLUSIONS

The best results are possible only when all factors are considered. The wide range of treatment furnishes a decidedly flexible and thoroughly individual method to meet the requirements of the patient. All concerned must co-operate to the utmost for the best interests of the patient.

Precancerous lesions under consideration should be adequately dealt with; proper means should be instituted for their control, and, in this way, as far as possible, the chance of malignant degeneration or change occurring should be prevented.

In the group in which palliation only can be expected, every endeavor should be made to avoid the production of radionecrosis. Instead, the selective absorption of the therapeutic rays should be employed. It is astonishing to observe the degree of palliation or the restoration of satisfactory function of the diseased part possible in certain cases.

The greatest chance of cure is in the case in which there is a small or early lesion of rather low grade of malignancy that has been adequately dealt with. Adequate treatment is possible only through co-operation of all concerned, and full realization of the value of surgery, radium, and roentgen rays.

BIBLIOGRAPHY

1. BAILEY, HAROLD, and QUIMBY, EDITH H.: The Use of Radium in Cancer of Female Generative Organs. *Am. Jour. Obst. and Gynec.*, February, 1922, III, 117-133.
2. BERKELEY, COMYNS, and BONNEY, VICTOR: Leukoplakic Vulvitis and its Relation to Kraurosis Vulvæ and Carcinoma Vulvæ. *Trans. Royal Soc. Med., Obst. and Gynec. Sect.*, 1910, III, 29-48.
3. BOWING, H. H., and FRICKE, R. E.: Radium Treatment of Carcinoma of the Cervix during 1927. *Am. Jour. Roentgenol. and Rad. Ther.*, June, 1929, XXI, 529-537.
4. BOWING, H. H., FRICKE, R. E., and SMITH, N. D.: Treatment of Malignant Tumors of the Rectum by Radium and Roentgen Rays. *RADIOLOGY*, November, 1929, XIII, 443-450.
5. BRODERS, A. C.: Epithelioma of the Genito-urinary Organs. *Ann. Surg.*, May, 1922, LXXV, 574-604.
6. Idem: The Grading of Carcinoma. *Minnesota Med.*, November, 1925, VIII, 726-730.
7. VON BÜBEN, IWAN: Die Radiumtherapie des Vulvacarcinoms. *Strahlentherapie*, 1929, XXXI, 713-719.
8. CABOT, HUGH: *Modern Urology*. Lea & Febiger, Philadelphia, 1924, I, 392-394.
9. CLARK, J. G., and NORRIS, C. C.: Radium in Gynecology. J. B. Lippincott, Philadelphia, 1927, p. 146.
10. COUNSELLER, V. S.: Leukoplakia Vulvitis or Kraurosis Vulvæ: its Relation to Carcinoma and its Surgical Treatment. *Minnesota Med.*, April, 1931, XIV, 312-318.
11. DIETRICH, H. A.: Erfolge der Mesothorium- und Radiumtherapie des Genitalkarzinoms an der Göttinger Universitäts-Frauenklinik. *Strahlentherapie*, 1920, X, 854-866.
12. DITTRICH: Quoted by Ewing, James.
13. DUNN, H. L.: Personal communication to the author.
14. EDERLE: Quoted by Taussig, F. J.
15. EWING, JAMES: *Neoplastic Diseases*. W. B. Saunders Co., Philadelphia, 1928, 3d Ed., pp. 604-606.
16. GIESECKE: Quoted by Taussig, F. J.
17. GRAVES, W. P.: *Gynecology*. W. B. Saunders Co., Philadelphia, 1928, 4th Ed., p. 324.
18. Idem: Early Diagnosis and Prophylaxis in Female Genital Cancer. *New England Jour. Med.*, Jan. 2, 1930, CCII, 1-7.
19. GURLT: Quoted by Ewing, James.
20. LEDDY E. T.: Personal communication to the author.
21. MACKEE, G. M.: X-rays and Radium in the Treatment of Diseases of the Skin. Lea & Febiger, Philadelphia, 1927, p. 626.
22. MILLER, C. J.: Minor Pathology of the Vulva. *Am. Jour. Surg.*, February, 1930, VIII, 368-371.
23. O'NEIL, R. F.: Primary Carcinoma of Male and Female Urethra. *Jour. Urol.*, April, 1921, V, 325-343.
24. PERRUCHET: Quoted by Taussig, F. J.
25. PETIT, PAUL: Quoted by Taussig, F. J.
26. POMEROY, L. A., and MILWARD, F. W.: Primary Carcinoma of Female Urethra Treated with Radium. *Surg., Gynec. and Obst.*, September, 1922, XXXV, 355-357.
27. RENTSCHLER, C. B.: Primary Epithelioma of the Vulva; Analysis of 71 Cases. *Ann. Surg.*, May, 1929, LXXXIX, 709-730.
28. ROTHCHILD: Quoted by Taussig, F. J.
29. SCHREINER, B. F.: Five-year End-results of Cancer of Vagina, Vulva, Clitoris, and Labia Treated by Irradiation. *Radiol. Rev. and Chicago Med. Rec.*, May, 1929, LI, 187-190.
30. SCHWARZ: Quoted by Ewing, James.
31. TAUSSIG, F. J.: *Diseases of Vulva*. D. Appleton and Co., New York, 1923.
32. Idem: Leukoplakia Vulvitis and Cancer of the Vulva (Etiology, Histopathology, Treatment, Five-year Results). *Am. Jour. Obst. and Gynec.*, October, 1929, XVIII, 472-503.
33. Idem: Leukoplakia and Cancer of the Vulva. *Arch. Dermat. and Syph.*, March, 1930, XXI, 431-445.

DR. BOWING (closing): In the paper I have stressed the importance of recognizing and treating as early as possible the so-called precancerous lesions occurring in the vulva, such

as pruritus vulvæ and leukoplakic vulvitis. In selected cases section of the internal pudic nerve or vulvectomy should be considered as a prophylactic or curative procedure.

Telestereoroentgenography. Louis Diocles. *Am. Jour. Surg.*, December, 1930, X, 499.

The author first describes the history of stereoroentgenography and then describes the theory and technic of producing stereoroentgenograms. Realizing that the stereoscopic image of a thick portion of the body, such as the thorax, made at a focal distance of less than a meter gives a defective plastic result, he feels that the use of teleroentgenography gives more definite and undisputed images whose superimposition is effected more easily. By the use of more powerful X-ray apparatus, good films can be made at these relatively great distances, using a short exposure.

In using this greater distance, unless the tube-shift distance is worked out carefully, the stereoscopic effect will be poor and the films appear flat. The author has therefore worked out by formula the amount of the tube shift for various focal distances. The time for the two exposures must be very short, as other-

wise any movement of the viscera may spoil the stereoscopic effect. He then describes the telestereoroentgenographic apparatus which he has had constructed and which is entirely automatic, and allows the making of a stereogram in a fraction of a second. He then describes several similar pieces of apparatus which are made by firms on the Continent.

The examination of the films can be carried out with the aid of two types of stereoscopes: First, mirror stereoscopes; and second, prism stereoscopes. He also describes the various commercial machines embodying these principles, and makes reductions from the films and examines these by the aid of a hand stereoscope. He states, however, that the best stereoscope and the simplest is our own visual apparatus. A slight muscular effort analogous to a trial strabismus allows the convergence of the optical axes and the perception of the relief. It is also possible to project these stereoroentgenograms by the use of a special lantern.

HOWARD P. DOUB, M.D.

THE TREATMENT OF COMPRESSED AND IMPACTED FRACTURES OF THE BODIES OF THE VERTEBRÆ¹

By JOHN DUNLOP, M.D., and CARL H. PARKER, M.D., PASADENA, CALIFORNIA

THE treatment of compression fractures of the bodies of the vertebræ has received a great deal of attention in recent years, since correct X-ray exposures have demonstrated the frequency of this injury.

Decompression has been accomplished in several ways by different men. The method of decompression and reduction to be described was originated in 1927, and has been very successful and has proven to be safe. This paper deals only with those cases which do not have symptoms of injury to the spinal cord and those cases in which the demonstrable injury is limited to the body of a vertebra.

The treatment is carried out in the manner to be described. The patient is given a general anesthetic to insure complete muscular relaxation during the process of decompression and reduction. Strong traction and counter-traction are obtained by having two men pull downward on the ankles while two others pull strongly upward on sheets crossed beneath the shoulders and over the chest. A sheet is folded to a width of eight inches and is passed beneath the injured segments as the patient lies on his back.

Then by means of this sheet the operator and his assistant toss the patient straight upward and catch his weight while he is still in hyperextension; the strong traction is maintained throughout this maneuver. The force of the manipulation can be graduated to the individual case. Where impaction is present considerable force may be necessary to disengage the fragments. On the other hand, in cases in which there has been comminution of the bone a gentle lifting motion will be found sufficient to restore the

various portions of the bone to their normal relations.

After the decompression has been done the reduction is maintained by placing the patient in marked hyperextension on a Goldthwait frame while he is still completely relaxed. The proper placing of the patient on a correctly curved bar is an essential step in this procedure. A cast is then applied in order to hold the corrected position. Experience indicates that the patient should not be placed in a face-down position while in the cast, as this has resulted in some reduction in the vertical height of a vertebral body which had previously been pulled out to a normal height. The time in the cast has usually been four months. In cases in which much bone destruction has occurred the time has been increased until the X-ray demonstrated the rebuilding of the bone structure.

During previous discussions of this subject the question has often been asked, "Is such radical and long-continued treatment necessary in these simple compression fractures?" The answer is, "Yes." The failure of immobilization and the failure even of stabilization operations to give satisfactory results, especially in industrial cases, is attested by Eikenbary, of Seattle, who reviewed two hundred cases in 1928. He stated as a result of this study:

In the list of state industrial patients whom I have examined or treated, together with the seventy-five patients whose records I have examined, only a few—not more than five—were returned to hard labor without a considerable percentage of disability, the figures ranging all the way from 10 per cent up.

These poor functional results are easily understood, because there is permanent deformity of the body of the vertebra and a

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1-5, 1930.

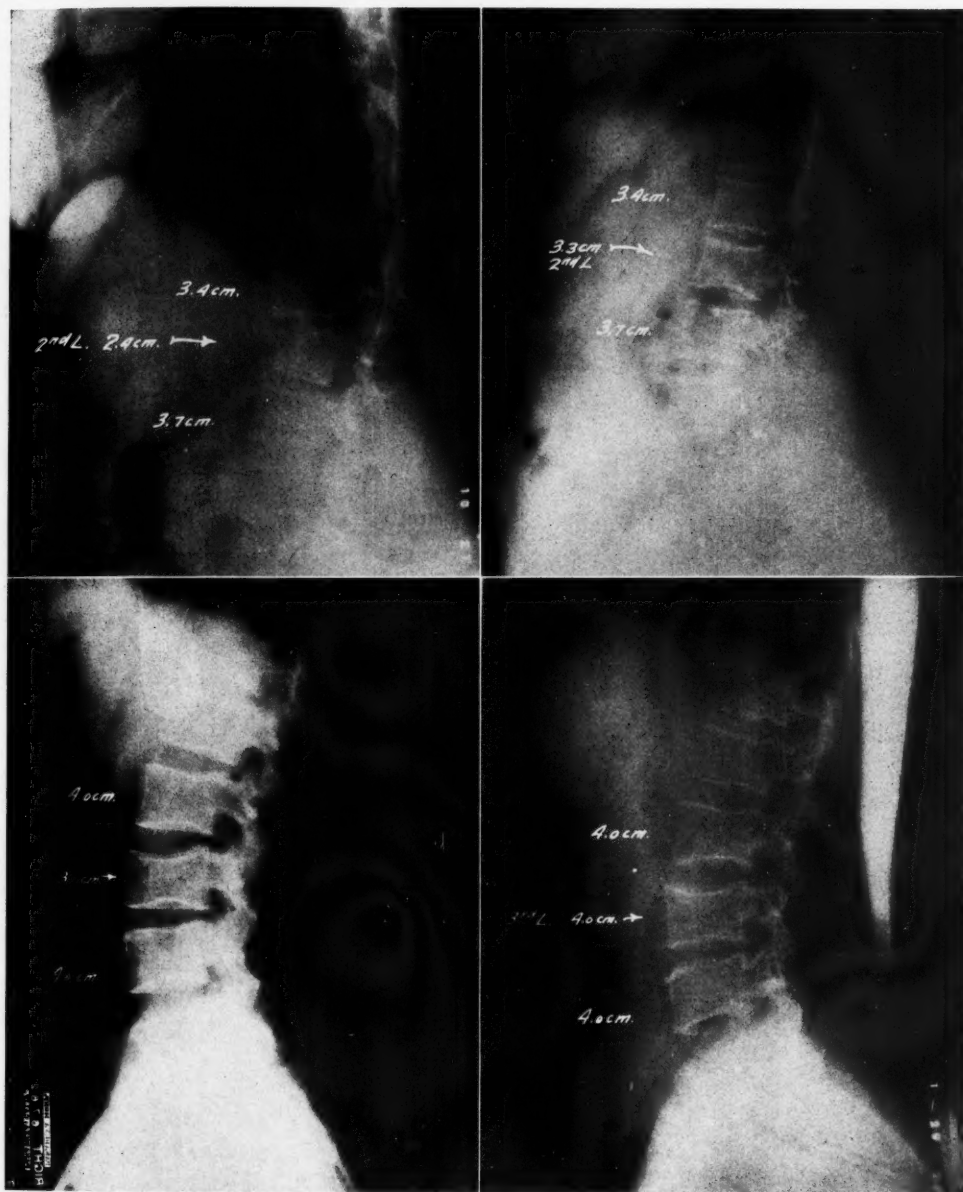


Fig. 1 (upper left). Case 1. Before reduction (October 10, 1927). Fracture of the second lumbar vertebra. The compression amounted to at least 1 centimeter. (Previously published in the *Journal of the American Medical Association*, 1930. Republished because this was the first fracture reduced by Dr. Dunlop.)

Fig. 2 (upper right). Case 1. This shows the appearance of the fractured vertebra 1 year 4 months after the reduction. (Previously published in the *Journal of the American Medical Association*, 1930.)

Fig. 3 (lower left). Case 2. Before reduction. Impacted fracture of the third lumbar vertebra in a heavy man. (Previously published in the *Journal of the American Medical Association*, 1930.)

Fig. 4 (lower right). Case 2. Six months after reduction. (Previously published in the *Journal of the American Medical Association*, 1930.) Republished because this man, a motorcycle officer, has returned to full duty and two recent serious falls have caused no recurrence of the deformity in the healed vertebra.

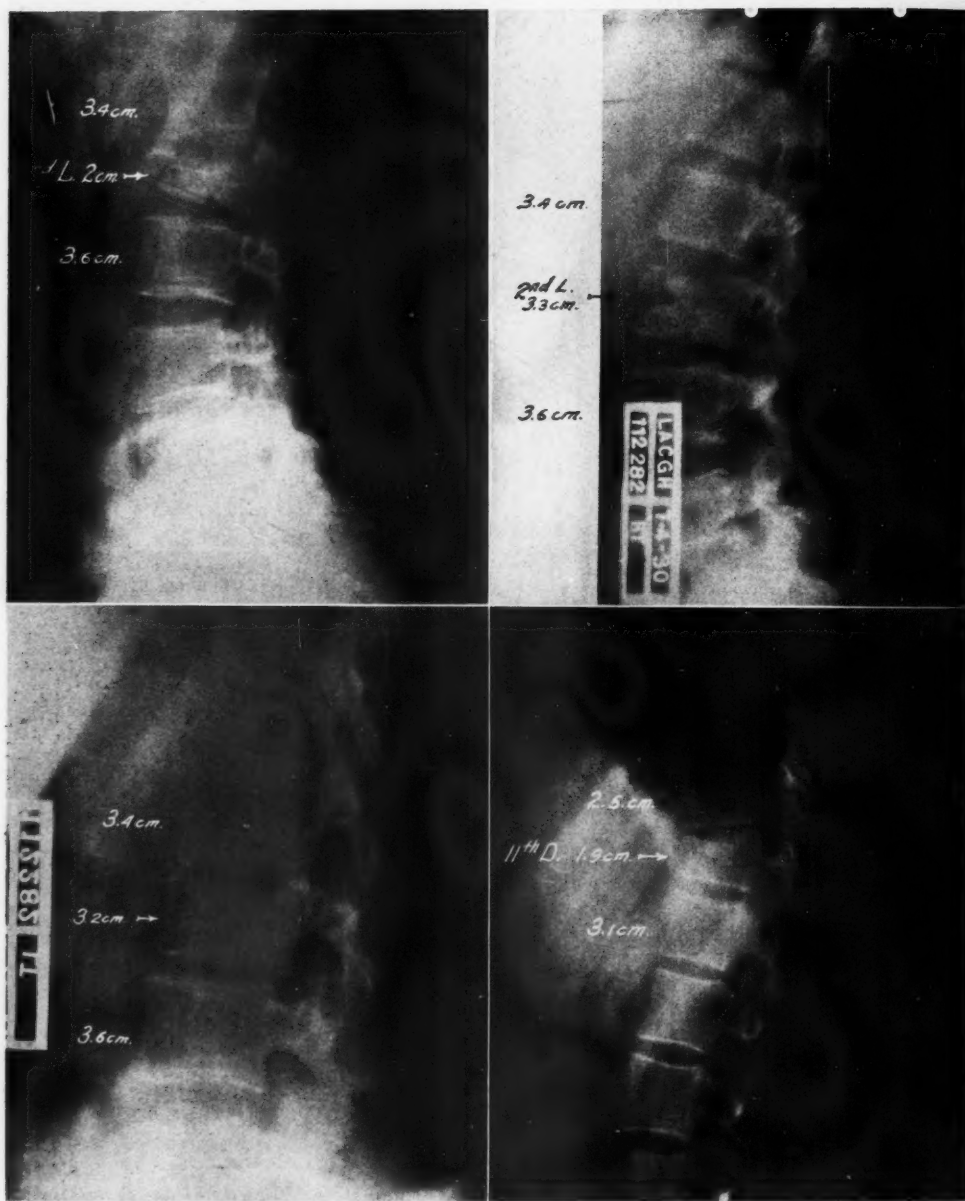


Fig. 5 (upper left). Case 3. A badly comminuted fracture of the second lumbar vertebra before reduction. The fragments are widely separated but are in nearly correct position.

Fig. 6 (upper right). Case 3. Patient in cast four days after reduction.

Fig. 7 (lower left). Case 3. Eight months after reduction, with the patient up and taking long walks. Note the very satisfactory healing of the bone and the height of the vertebral body.

Fig. 8 (lower right). Case 4. Compression fracture of the eleventh dorsal before reduction.



Fig. 9 (upper left). Case 4. Four days after reduction. The compression was completely overcome.

Fig. 10 (upper right). Case 4. One year after reduction. The injured vertebra lost height while the patient was in her cast, probably because she was frequently turned face down in the cast. After the bone healed there was no further loss in height. There is also narrowing of the intervertebral space above.

Fig. 11 (lower left). Case 5. Compression fractures of the sixth and seventh dorsal vertebræ before reduction.

Fig. 12 (lower right). Case 5. Four days after reduction. This patient illustrates the difficulty of obtaining complete reductions above the level of the ninth dorsal.

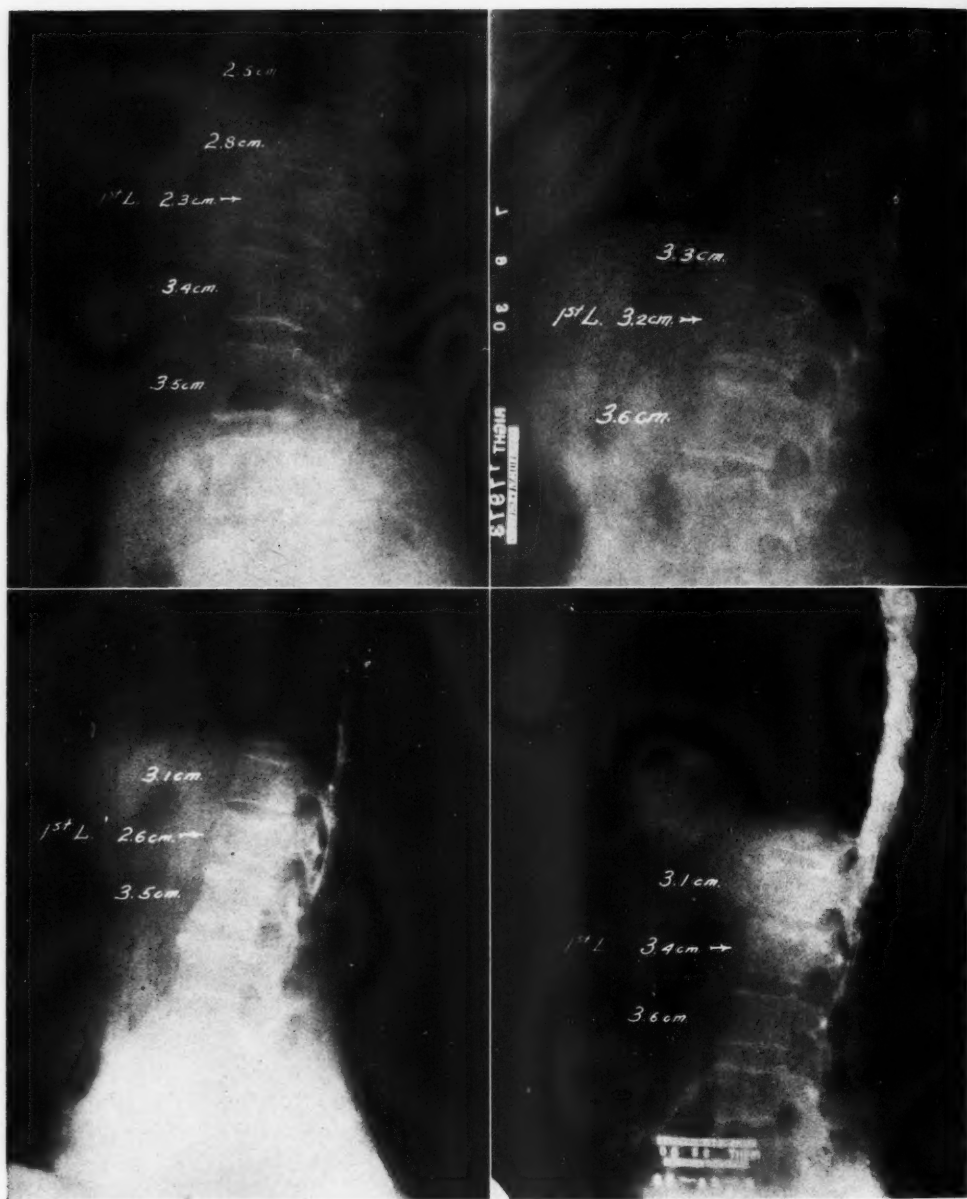


Fig. 13 (*upper left*). Case 6. Compressed fracture of the first lumbar before reduction. (Patient of Dr. Frank Hodgdon, of Pasadena.)

Fig. 14 (*upper right*). Case 6. Nine months after reduction. (Patient treated by Dr. Frank Hodgdon, of Pasadena.)

Fig. 15 (*lower left*). Case 7. Compression fracture of the first lumbar vertebra before reduction. (Patient of Dr. Robert K. Gustafson, of Pasadena.)

Fig. 16 (*lower right*). Case 7. Five days after reduction. (Patient treated by Dr. Robert K. Gustafson, of Pasadena.)

mal-alignment which causes even the undamaged articular facets to move abnormally in relation to each other. In many of the uncorrected cases there is an angle in the spine, with the apex of the angle opposite

restore him to normal health or to compensate him for permanent disability. The demonstration in court of roentgenograms showing the reduction and restoration of the fractured vertebræ should result in a fair



Fig. 17. The Goldthwait bars, which can be bent to any desired height, to insure the proper degree of hyperextension in the cast.

the injured segment. A final evaluation of the new method must depend on experience with many cases over a long period of time. Suffice it to say that the results thus far have been excellent, with several patients back at heavy work without any disability. The most striking instance is that of a police motorcycle officer who showed a perfect anatomical and functional result and returned to his regular duties after seven months. He has since suffered two severe falls from his machine in the course of duty without evidence of any further injury to his repaired second lumbar vertebra.

The psychological effect of complete reduction and healing of the bone is of major importance in industrial and medico-legal cases. The person injured in an industrial or railroad accident expects the company to

award instead of the excessive damages so often given in the past. The intelligent employee or private patient with a broken back will be made to feel that he has been given correct and effective treatment for his condition, and will have greater confidence in returning to his ordinary duties.

Two other points deserve consideration: First, will the surgeon succeed in accomplishing a reduction, and second, is it a safe procedure?

In our hands practically all of the thirty cases have shown a satisfactory reduction; naturally, some reductions have been more nearly perfect than others. The less perfect reductions were obtained in injuries above the ninth dorsal and in one case in which the treatment was delayed twelve days because of a threatened pneumonia. Excel-

lent reductions have also been obtained in Pasadena and Los Angeles by other surgeons. Anatomically, the success of the manipulation depends on intact articular facets, the strong anterior longitudinal ligament, and the firm attachment of the vertebral discs to the bodies of the vertebræ.

None of our patients have developed any evidence of cord injury. The safety of the procedure depends on intact articular facets, on the strong traction which tends to restore normal alignment, and finally, on the fact that all the applied force is in the direction

of hyperextension; the patient is never in flexion during the procedure of reduction.

SUMMARY

Our experience with this method of treating compression fractures of the bodies of the vertebræ leads to the conclusion that the method will succeed in the great majority of cases and that it is quite safe when good judgment and common sense are employed. The steps in the procedure have been carefully outlined—we consider each detail essential.

NEW YORK CITY AND THE CANCER PROBLEM¹

WHAT THE MUNICIPALITY IS DOING IN THE CARE AND TREATMENT OF CANCER PATIENTS, IN PROPAGANDA FOR PREVENTION OF CANCER, AND IN RESEARCH WORK FOR CANCER THERAPY

By IRA I. KAPLAN, B.S., M.D.,

Director, Division of Cancer, Department of Hospitals; Radiation Therapist, Bellevue Hospital; Associate Radium Therapist, Lenox Hill Hospital; Consultant Radiation Therapist, Unity Hospital, Brooklyn; Clinical Professor of Surgery, New York University and Bellevue Medical College, NEW YORK CITY

From the Division of Cancer, Department of Hospitals, New York City, Dr. J. G. William Greeff, Commissioner

THE problems which confront the welfare agencies of the City of New York in caring for its sick are indeed tremendous and not the least difficult of these is the care of sufferers from cancer. The secondary aim is its effort to conduct a widespread campaign among the profession and the laity for cancer prevention. To attain these objectives a Division of Cancer has been created, which concerns itself with the

CANCER DEATHS ARE INCREASING NEW YORK CITY

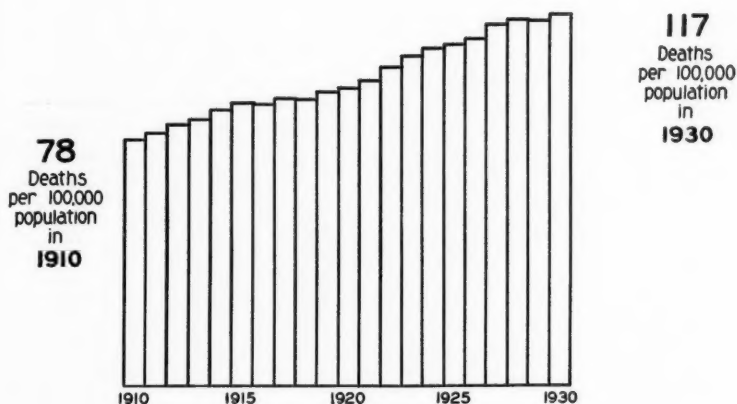


Fig. 1.

primary aim of the Department of Hospitals in this connection is, naturally, the amelioration of the conditions presented, with the hope of obtaining a cure in each case. A

diagnosis, care, and treatment of cancer patients in the hospitals and clinics of the Department; with informing the public, in co-operation with other health agencies, regarding cancer and its prevention; with educating the profession in the diagnosis and treat-

¹Read before the Third International Congress on Radiology, Paris, July, 1931.

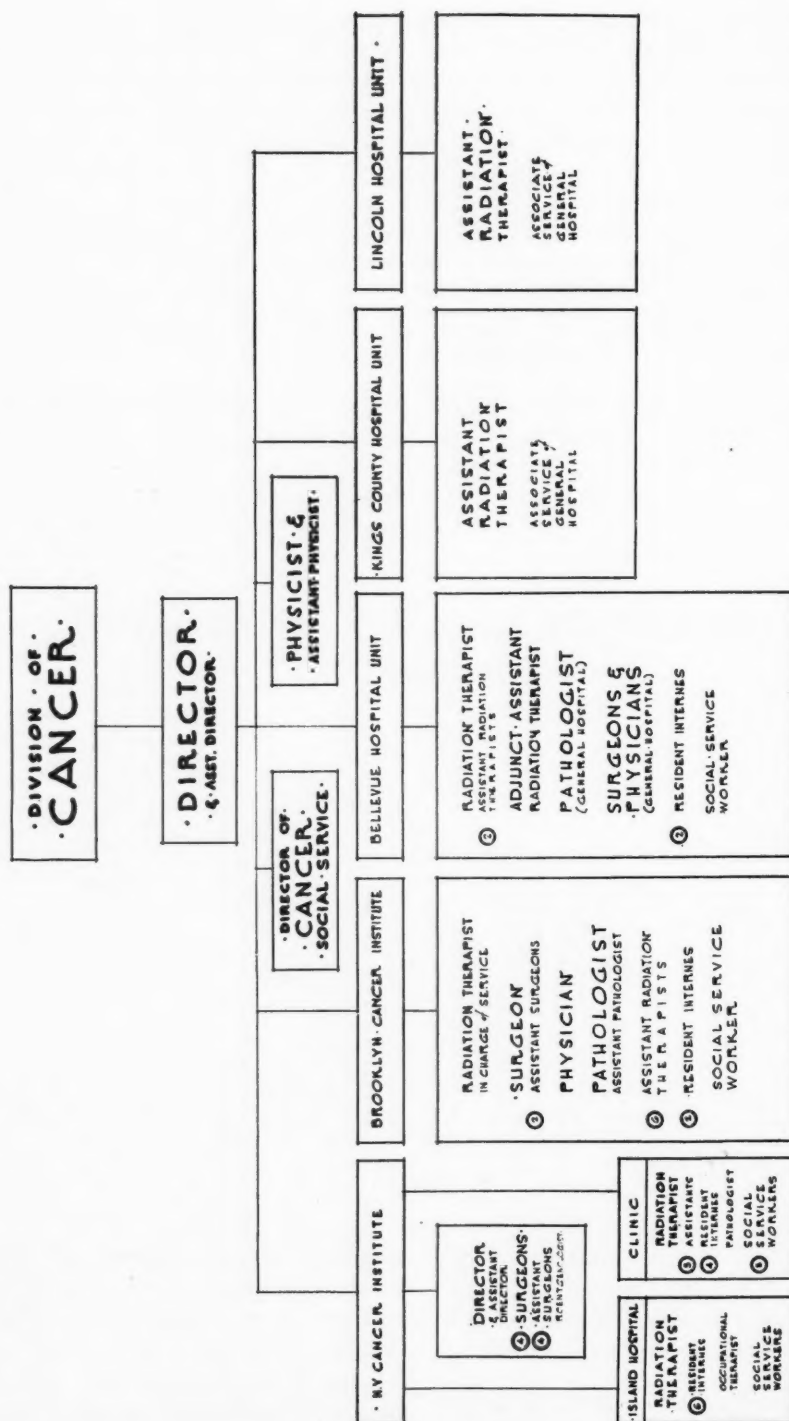


Fig. 2.

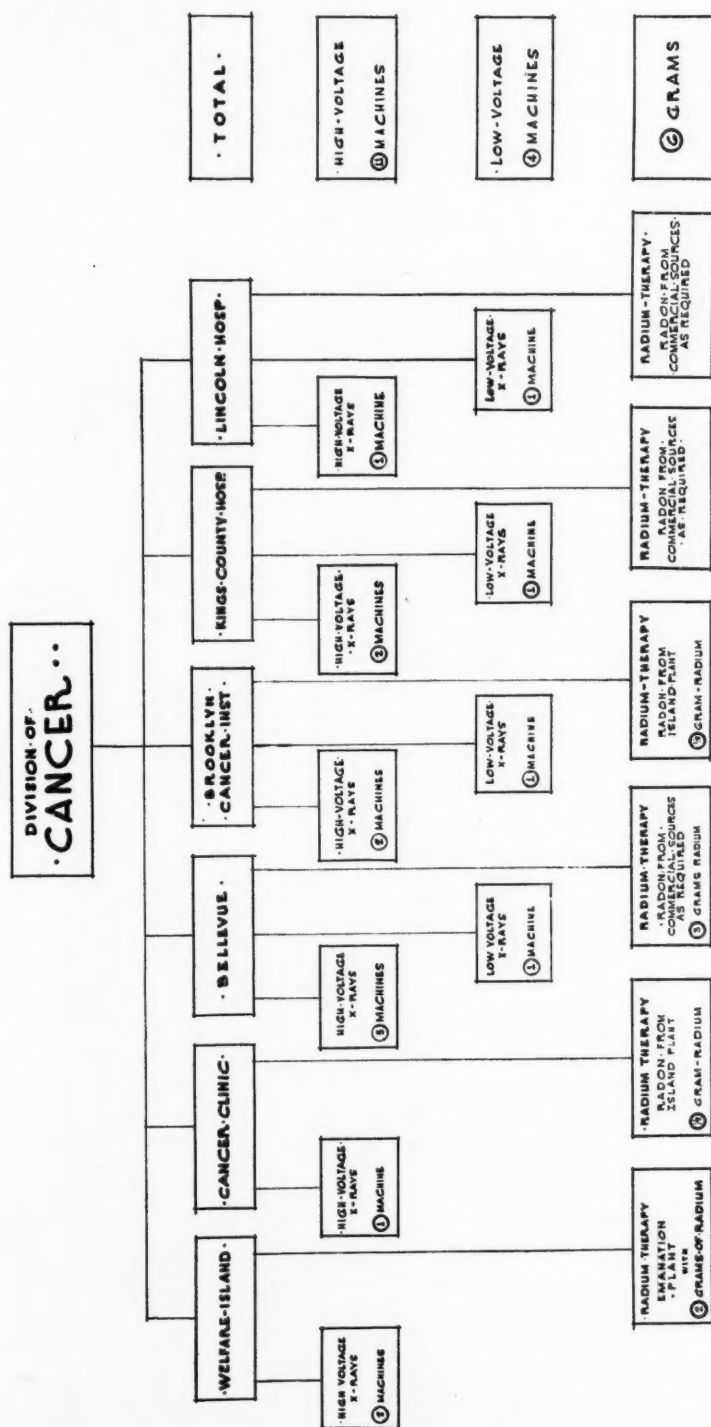


Fig. 3.

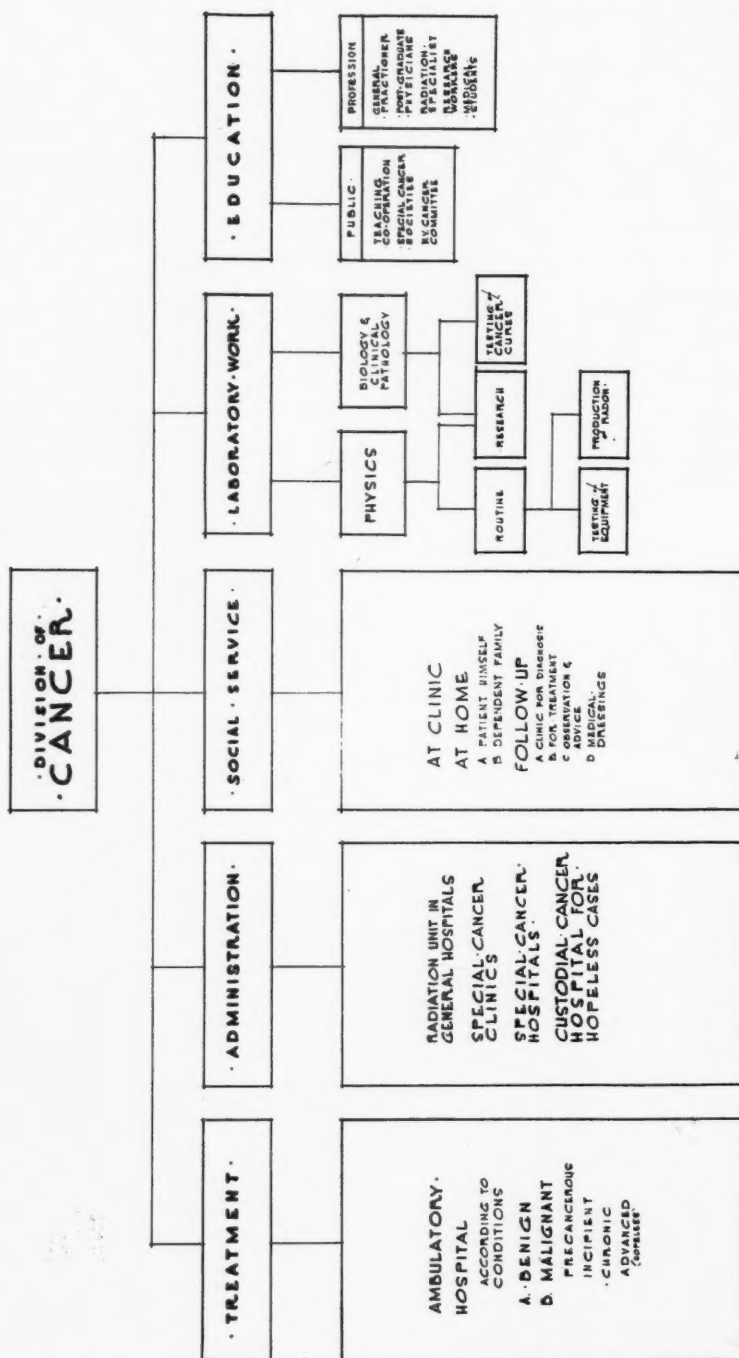


Fig. 4.

ment of cancer, and with conducting research work in the origin, cause, treatment, and prevention of cancer.

During the year 1930 there came under the jurisdiction of the Division approximately 7,000 cases, benign and malignant. To provide for future requirements, the City of New York has planned and already started to build a new special hospital of 400 beds to care for cancer patients. This will be the largest hospital of the kind in the United States, if not in the world, devoted exclusively to the diagnosis of cancer, the care and treatment of cancer patients, research work in the cause and cure of cancer, and the instruction of the lay public as well as of students and practitioners of medicine.

The hospitals constituting the municipal system are open to all citizens, irrespective of race, color, or creed, and the treatment is given free of cost to all patients admitted. All kinds of patients are received, suffering from all types of diseases, and in various stages and conditions. Cancer patients may come to any hospital in the system, but as the modern practice is to segregate patients afflicted with special diseases, such as tuberculosis, specific infection, etc., cancer cases are referred as far as possible to those units in the general hospital system where specialized care and treatment can be given them by a specialized organization.

Cancer patients may be grouped as incipient, chronic, and hopeless.

Incipient Cases.—Positive cure is contingent on two factors—early diagnosis and prompt, appropriate treatment, whether this be surgery, radiation therapy, or both. Therefore a grave responsibility rests upon the surgeon and the therapist in that each must employ the correct procedure at the outset, for if the surgical excision is incompletely done or the radiation improperly administered, the left-over malignant growth may develop all the more vigorously, and,

as is known, secondary attempts at cure are less likely to prove successful.

Chronic Cases.—With our present knowledge, we can expect in chronic cases little more than palliative results, although spectacular cures may sometimes occur. While it is possible, however, to prolong the life of the patient, to do so is not always easy nor at times even advisable, for the prolonged existence may prove to be one of exquisite pain. Thus, irradiation of an incurable tumor, while prolonging the patient's life, has not infrequently been followed by necrosis, producing a painful condition which, to the patient, may be worse than death itself. Chronic cases must remain under constant supervision, therefore, with the treatments being administered only by those already familiar with the conditions and the methods used for their care.

Hopeless Cases.—These are adequately cared for in a custodial hospital where their gradual transition from life is rendered as painless and as comfortable as possible. The ever-increasing progress being made in the care and treatment of incipient and chronic cases makes it not unreasonable to expect that the number of hopeless cancer cases will steadily diminish.

For the purpose of carrying out this work the Division of Cancer has established separate cancer hospitals as well as special radiation units in several of the large general hospitals in the City's (hospital) system.

The headquarters of the Division of Cancer is the Radiation Unit at Bellevue Hospital, the largest municipal institution for the care of the sick, and the model after which the others are patterned. It is closely associated with the surgical, medical, and pathological staffs of the hospital itself and of the New York University and Bellevue Medical College. Besides possessing a special ward for radium therapy, it has at its disposal as many beds in the general wards of the hospital as may be needed for the

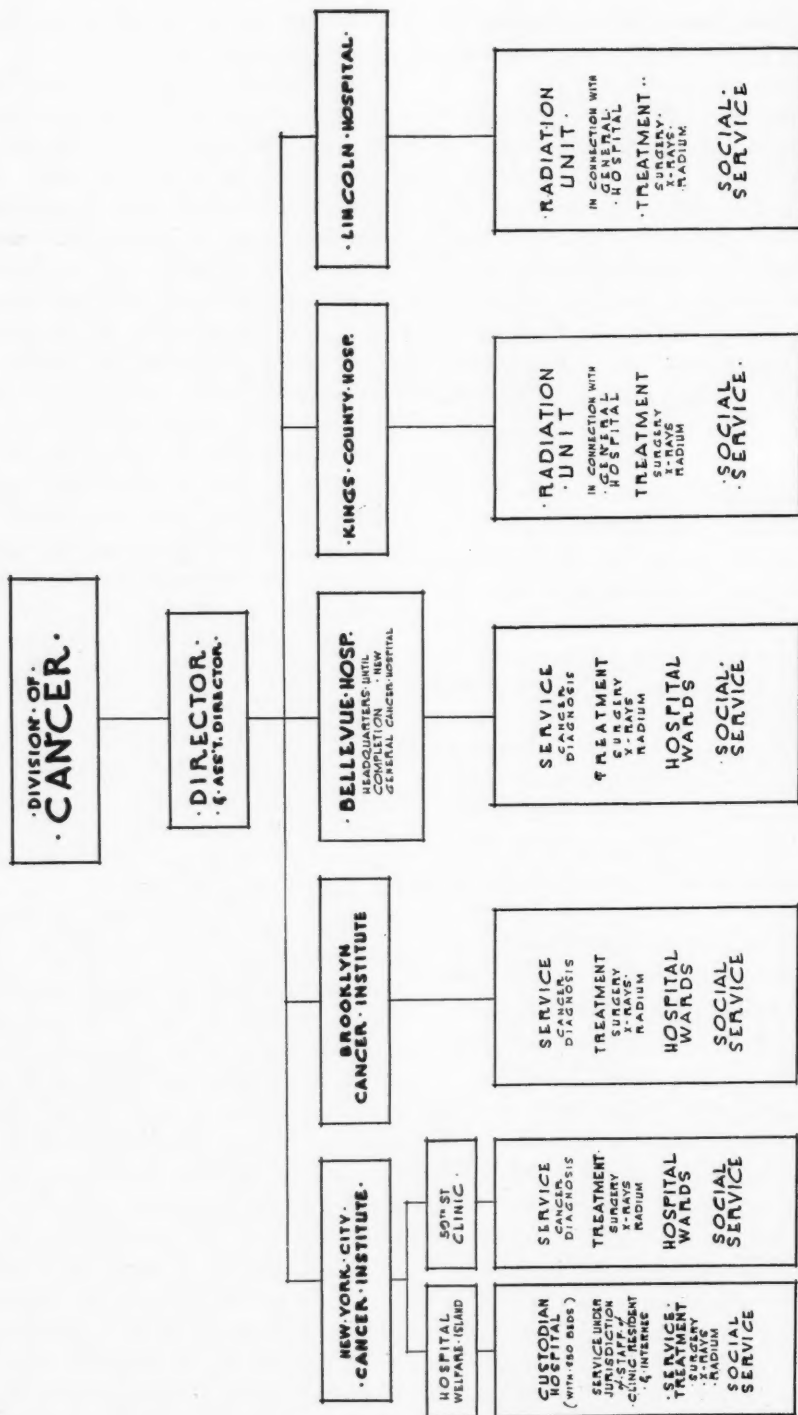


Fig. 5.

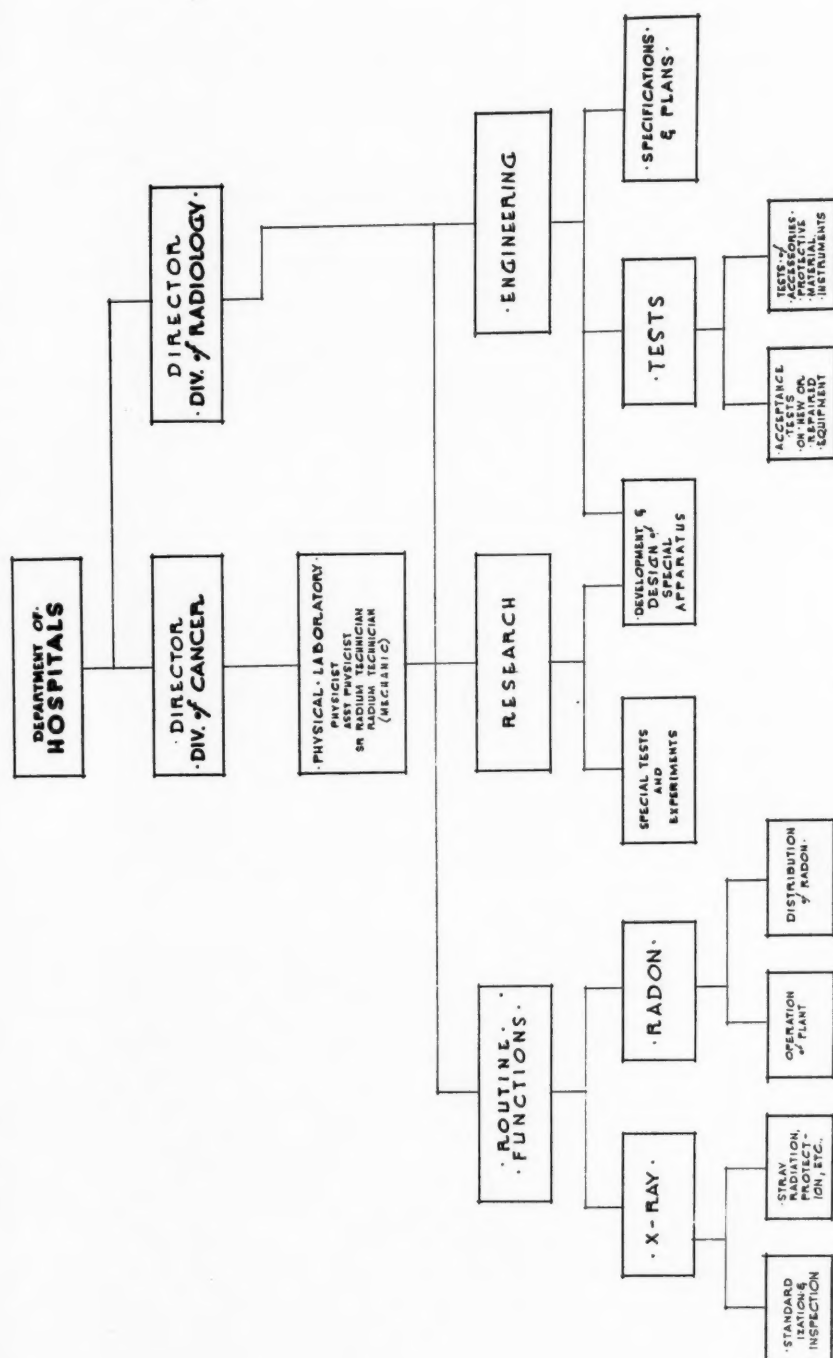


Fig. 6.

RADIATION THERAPY UNIT BELLEVUE HOSPITAL

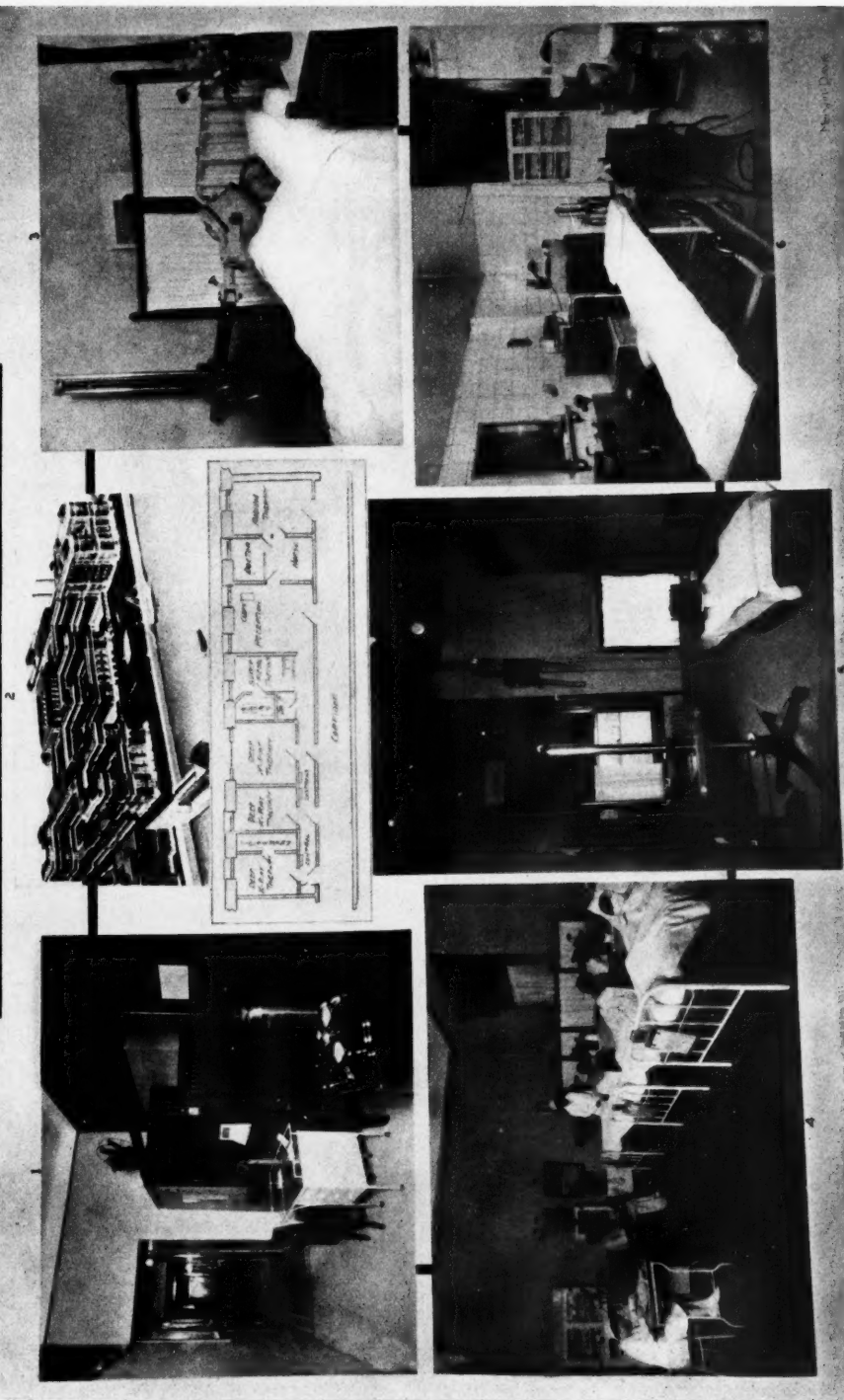


Fig. 8. (1) X-ray Therapy Department. (2) Bellevue Hospital; plan of Radiation Unit. (3) Portable Radium Pack. (4) Radium Ward. (5) X-ray Therapy Treatment Room. (6) Operating and Radium Treatment Room.

treatment of such of its patients as require hospitalization. It is manned by a regularly appointed trained staff, and is thoroughly equipped with adequate, up-to-date X-ray therapy apparatus and with a large supply of radium element.

Patients are received in this unit from the wards and dispensary of Bellevue Hospital, from other hospitals and clinics, or from physicians not attached to hospitals. Both benign and malignant conditions requiring radiation therapy are treated and those requiring institutional care are hospitalized. In connection with the Medical College, instruction in the diagnosis and treatment of cancer is given by members of the staff to both undergraduate and graduate students. This instruction is given either in an elementary form for students and general practitioners, or in an advanced course for those specializing in radiation therapy. A considerable amount of research in cancer is also carried on in co-operation with the large well equipped pathological laboratories of the hospital.

The routine procedure in caring for patients is as follows: When a patient is referred to the Radiation Department he is thoroughly examined and consultation had with the medical man, the surgeon, the pathologist, and the radiation therapist. Where possible, a biopsy is done in all accessible lesions. No radiation therapy is carried out until the proper diagnosis has been made in each case. Should surgical interference be indicated, the patient is referred to the service best able to render that form of therapy. Where radiation therapy is required, it is carried out either entirely by the radiation staff or under its immediate supervision in conjunction with other divisions of the hospital. Photographs are taken, when possible, to show the lesion before and after treatment. A follow-up observation of all patients handled by the Radiation Department is carried on through

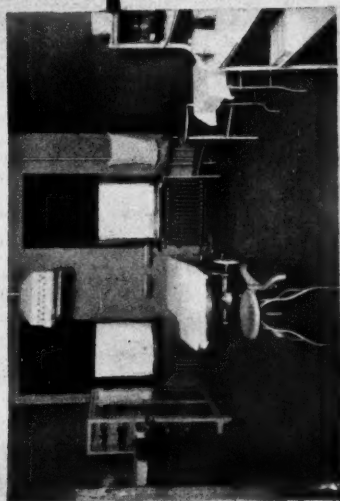
the assistance of the Social Service for Cancer. The Social Service Department maintains contact with all patients, insists upon regular attendance at the clinics for treatment, and also gives assistance in a material way to such patients as are unable during the time they are undergoing treatment to support themselves and their dependents.

The specialized cancer hospitals established by the Division are two in number at the present time, one in the Borough of Manhattan and the other in the Borough of Brooklyn. These are complete hospitals for the diagnosis, treatment, and care of cancer patients, and are manned by a full hospital staff. They have complete roentgenographic and pathological departments, offer a general medical and surgical service, and a complete radiation therapy service for the treatment and care of cancer, irrespective of the stage in which the case may be. The equipment includes adequate, up-to-date X-ray therapy apparatus, a large quantity of radium, and a suitable supply of radon from the emanation plant of the Division.

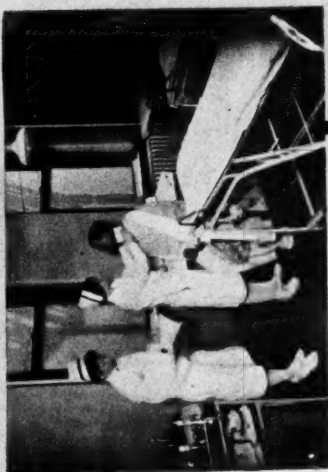
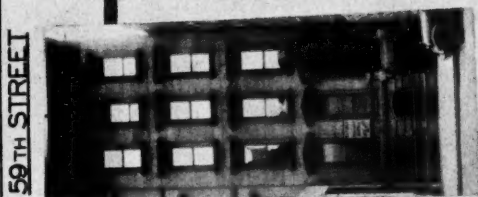
For the care of hopeless cancer cases there is a Custodial Hospital of 250 beds maintained by the Division and situated on Welfare Island. Future plans call for enlarging this hospital to enable it to care for 400 patients. It is equipped to carry on palliative treatments with surgery, X-rays, and radium. To this hospital are sent all the hopelessly involved cancer cases referred to the general municipal hospitals, and cases treated by other cancer hospitals, clinics, or physicians, in which the treatment given has failed to hinder the growth of the disease. In this custodial institution all efforts are directed towards ameliorating the sufferings of the hopeless patients confined there and to making their lingering exit from life as mercifully free from discomfort as possible. If permitted to remain idle the patients would find this period of waiting almost

DEPARTMENT OF HOSPITALS OF THE CITY OF NEW YORK

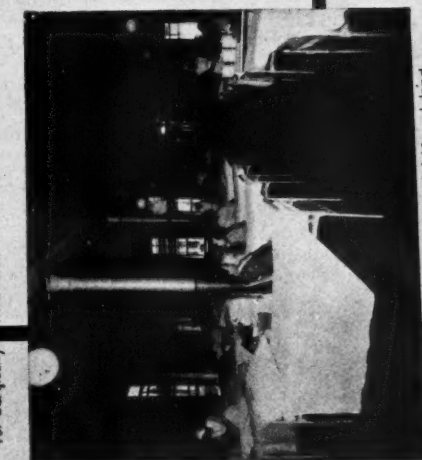
CANCER INSTITUTE 59TH STREET



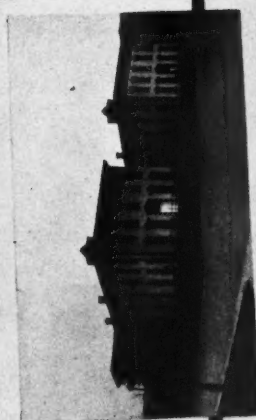
Operating room for surgery at 59th Street clinic where cancer patients are cared when this method of treatment is indicated.



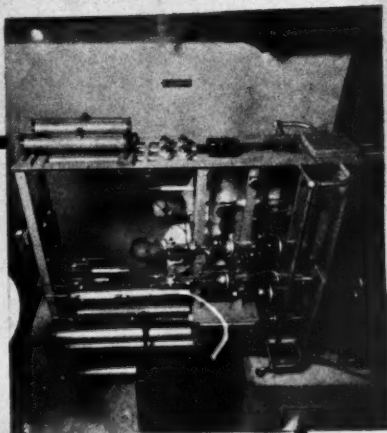
Radium treatment room, New York City Cancer Institute, 59th Street



Ward in Custodial Hospital, Welfare Island



WELFARE ISLAND



Radium emanation plant, Welfare Island

Fig. 9.

NEW YORK CITY CANCER INSTITUTE

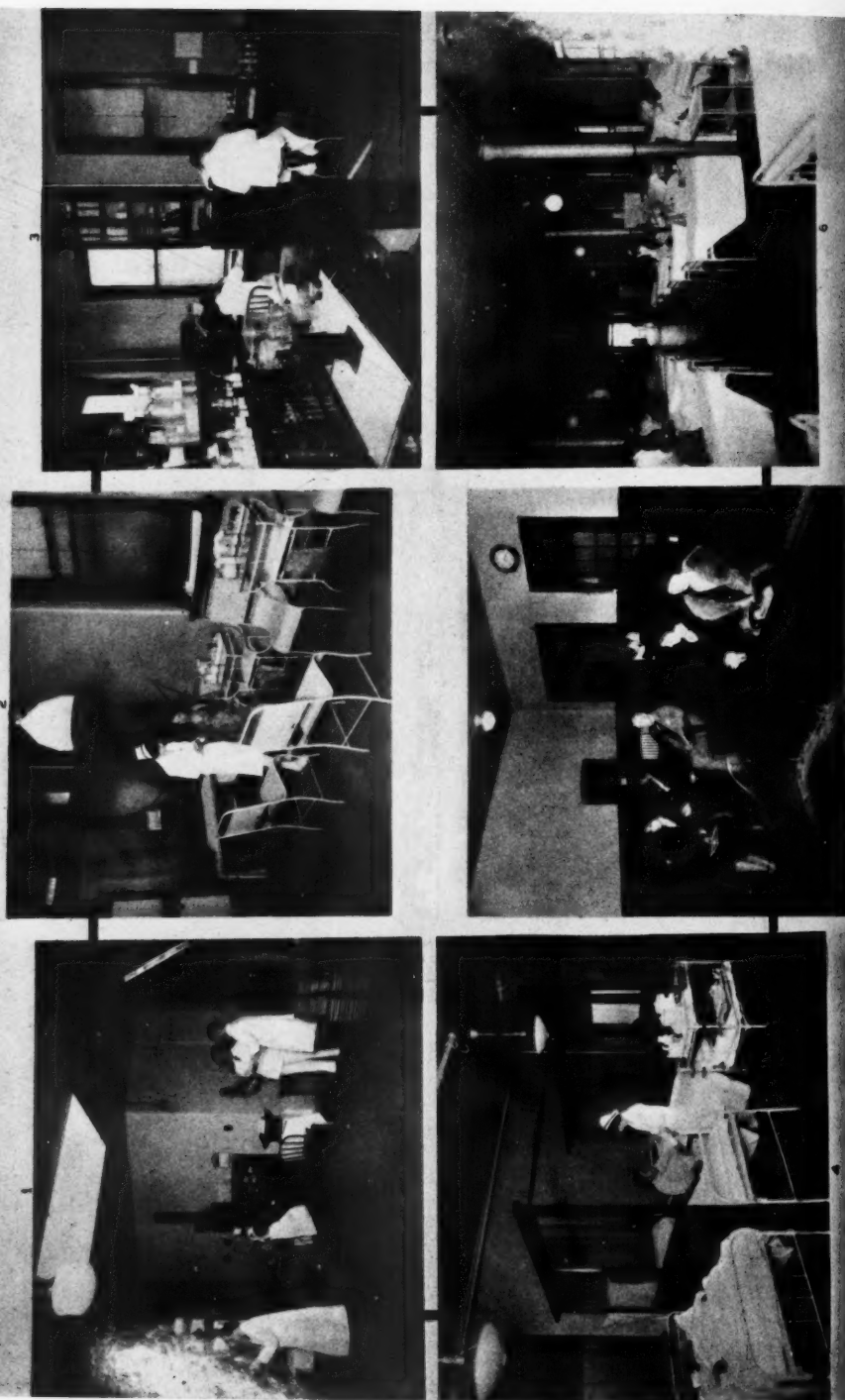


Fig. 10. (1) X-ray Therapy Department. (2) Clinic Examining Room. (3) Cubicle Ward, Cancer Clinic. (5) Waiting Room. Cancer Clinic. (6) Male Cancer Ward, Island Hospital.

unendurable, and so the Social Service Department of the Division of Cancer interests

them in various forms of occupational therapy, thereby keeping their minds occupied in

CASES REFERRED TO CANCER DIVISION TOO FAR ADVANCED FOR TREATMENT

BREAST CASES



Fig. 11. Showing the type of patients referred for treatment when effective therapy can no longer be administered. All these cases have distant metastasis already present. Some of them received some sort of treatment in an earlier stage from physicians, druggists, and friends.

CASES REFERRED TO CANCER DIVISION TOO ADVANCED FOR EFFECTIVE TREATMENT

MOUTH CASES

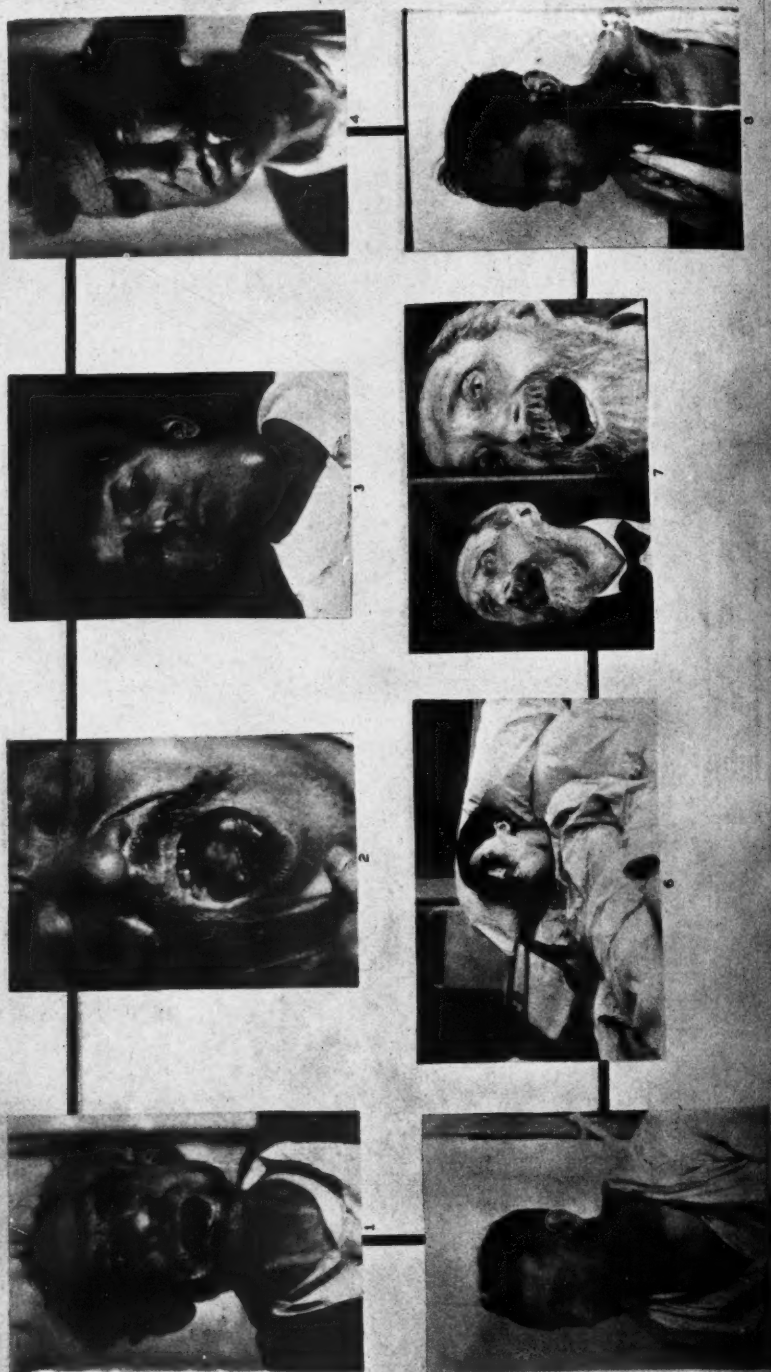


Fig. 12. (1) Carcinoma of the floor of the mouth; metastasis to the neck. (2) Epithelioma of the tongue. (3) Sarcoma on the floor of the mouth; had been operated on as an abscess. (4 and 5) Epithelioma, secondary from the floor of the mouth. (6) Sarcoma of the tongue. (7 and 8) Epithelioma of the floor of the mouth.

CASES REFERRED TO CANCER DIVISION TOO ADVANCED FOR EFFECTIVE TREATMENT

FACE CASES



Fig. 13. (1, 2, and 3) Rodent ulcer of the face. (4) Parotid tumor. (5) Epithelioma of the ear. (6 and 7) Epithelioma of the face.

physical work rather than in brooding over the thought of approaching death.

In carrying on its radiation work the Division adopts the methods best suited for

CASES BEFORE AND AFTER TREATMENT BY X-RAY THERAPY

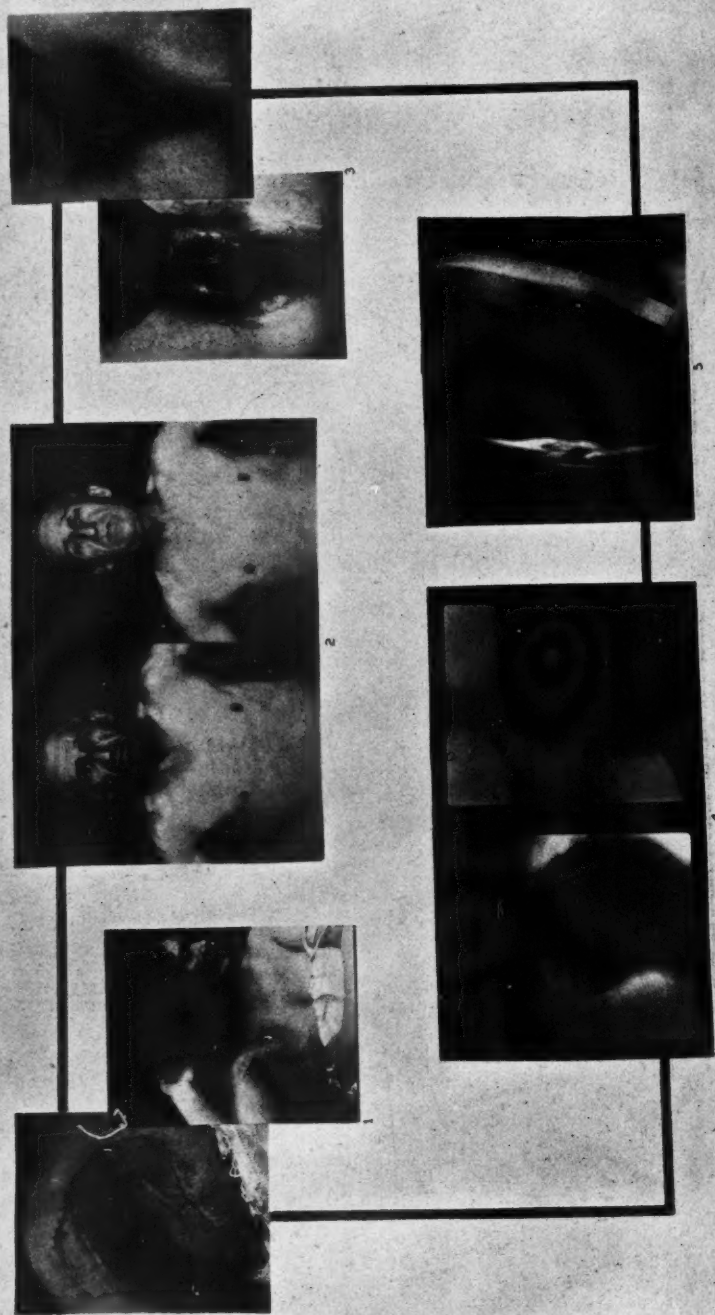


Fig. 14. (1) Post-operative recurrent carcinoma of the breast before and after treatment with X-rays. (2) Generalized Hodgkin's disease before and after treatment with X-rays. (3) Condyloma of the vulva before and after treatment with X-rays. (4) Lymphosarcoma of the chest before and after treatment with X-rays. (5) Bone sarcoma before and after treatment with X-rays.

SURFACE LESIONS BEFORE AND AFTER TREATMENT

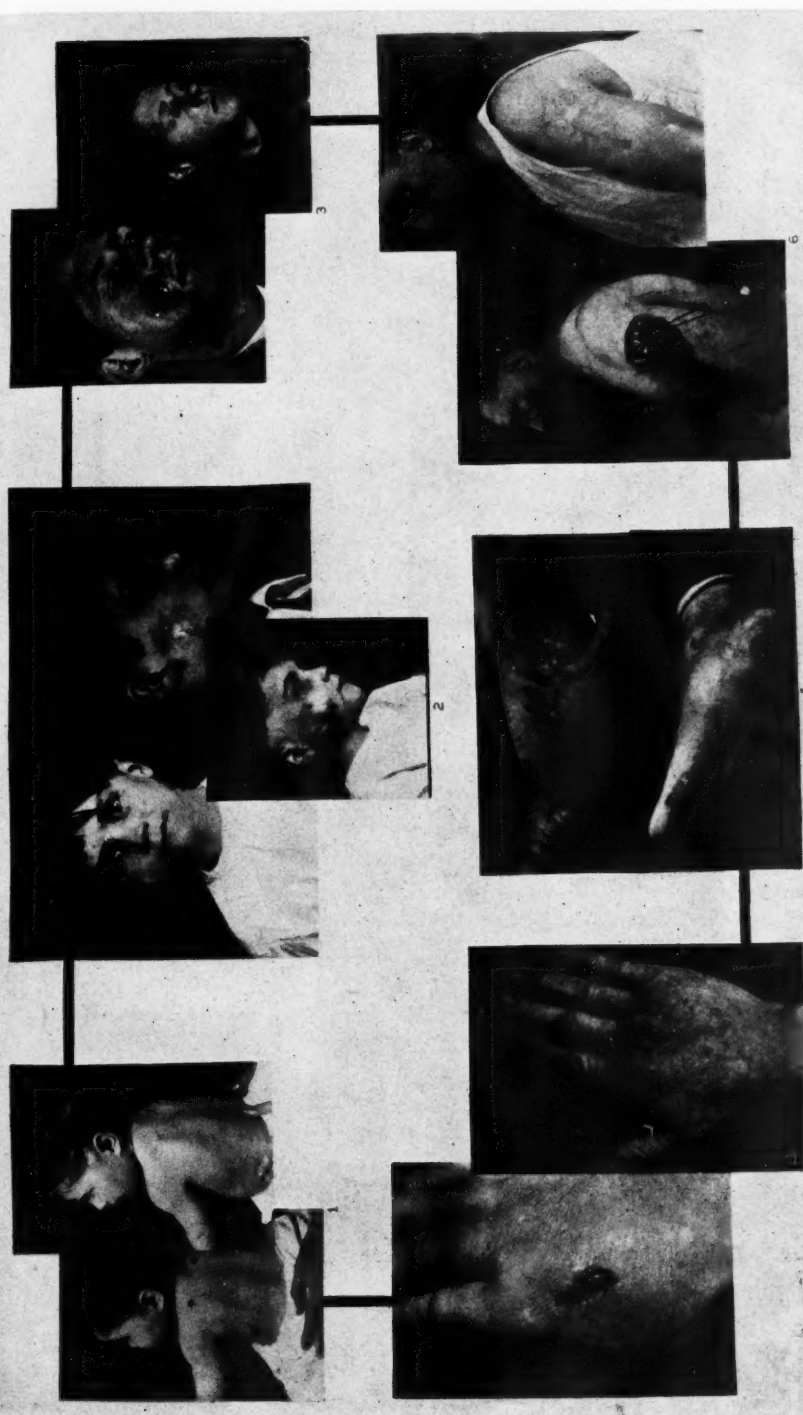


Fig. 15. (1) Multiple hemangioma before and after treatment with radium surface applicator. (2) Hemangioma of the face before and after treatment with radium needle puncture. (3) Lupus of the face before and after treatment by endotherapy and X-rays. (4) Epithelioma of the hand before and after treatment with surface radium mold. (5) Melanosarcoma of the foot before and after treatment with X-rays, surgery, and radium. (6) Sarcoma of the arm before and after treatment with X-rays, surgery, and radium.

FACE CASES BEFORE AND AFTER RADIUM TREATMENT



Fig. 16. (1, 3, and 5) Cancer of the face before and after treatment with surface radium applicator. (2) Cancer of the nose before and after treatment with surface radium applicator. (4) Cancer of the ear before and after treatment with surface radium applicator.

LIP AND MOUTH CASES BEFORE AND AFTER TREATMENT



Fig. 17. (1) Epithelioma of the lip before and after treatment with radium needle puncture. (2) Epithelioma of the lip before and after treatment with radium mold. (3) Tuberculosis of the lip before and after treatment with radium mold. (4) Epithelioma of the tongue before and after treatment with X-rays, surgery, and radium. (5) Sarcoma of the mouth before and after treatment with X-rays, surgery, and radium. (6) Carcinoma of the mouth before and after treatment with X-rays, surgery, and radium.

its patients, based on the technic in use in Sweden. Moreover, it has devised special apparatus and applicators peculiar to the

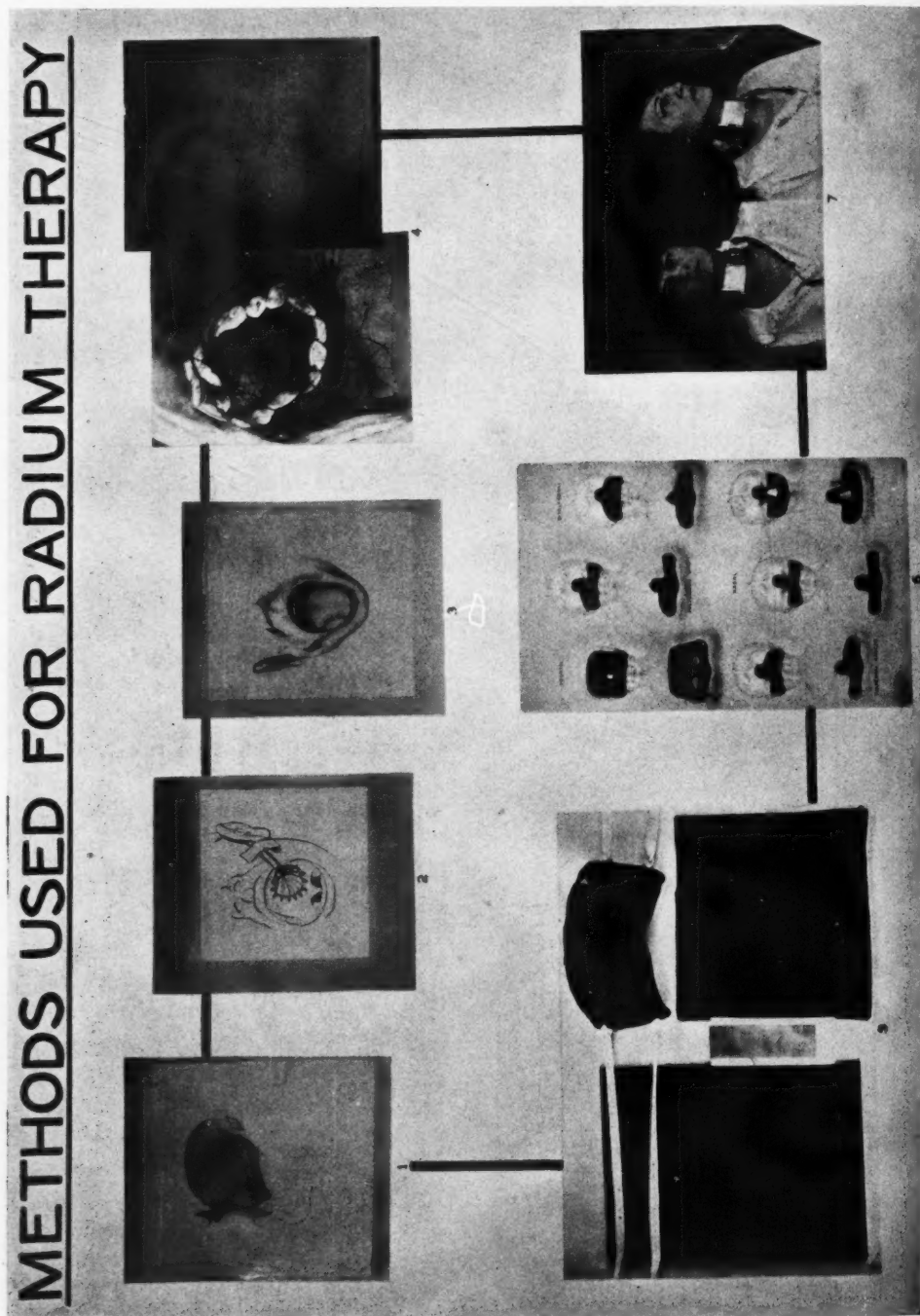


Fig. 18. Methods employed in radium therapy: (1) lesion of the tongue; (2) lesion of the palate; (3) wax for making molds; (4) various shapes made by radon wax; (5) lesion of the cheek; (6) lesion of the tongue; (7) radium mold for surface radium treatment of the thyroid.

technic of its own staff, for the treatment of cancer of the cervix, rectum, breast, and esophagus, and these have been described in contributions to the various medical journals as representing some of the scientific activities of members of the staff attached to the Division.

The City of New York owns approximately five and one-half ($5\frac{1}{2}$) grams of radium element, two grams of which are in solution for the manufacture of radon or radium emanation. The radium element is in tubes and needles of various sizes, with special long needles for the newer therapy of breast cancer. The radium emanation plant is centrally located on Welfare Island, in connection with the Custodial Hospital there.

In order to administer treatment to patients in accordance with the most modern methods, the Division of Cancer is prepared to utilize every known scientifically approved remedy. To evaluate proffered cancer cures, the Division accepts for testing all such proposed remedies. For this purpose there has been established in the Division of Cancer, a Cancer Cure Committee, composed of a pathologist, a surgeon, a physicist, a radiation therapist, and the Division Director, which Committee examines all submitted cures, passes upon their value, and decides upon the advisability of their being tried in the treatment of the city's patients. In connection with its work this Committee has set up the following criteria by which all proposed cures are judged and to which they must conform: (1) The constituents or ingredients must be disclosed; (2) a substantial quantity must be supplied to the Committee for the purpose of proper testing; (3) the tests are to be carried out under the jurisdiction of the Committee on the Cancer Division service; (4) the tests are to be made only on patients pathologically proven to have a malignancy; (5) if the cure proves efficacious, it must be made freely available

for use by the Division of Cancer and by the profession at large, due credit being given the originator; (6) the Committee reserves the right to publish all facts regarding the tests.

During the past few years the Division has received and tested a great many so-called cures, but unfortunately none has been found to have real value. No methods or substances offered for superficial treatment of cancer present any superiority over those tried remedies—surgery, X-rays, and radium. The biological cures offered have in our hands proven useless.

An integral part of the Division is the Department of Physics, organized to standardize the radiation work of the constituent units of the Division. This special department, staffed by trained physicists, tests all apparatus in the X-ray departments of all the hospitals in the municipal system, makes all necessary physical measurements required for standardizing the apparatus, has charge of the Radium Emanation Plant and of the planning of new buildings, apparatus, etc., for the entire Division. All X-ray therapy apparatus used is standardized according to the biological and also the International X-ray Unit. This department also conducts (scientific) research, experiments, and studies in the physics of radiation.

Experience has shown that to reduce the incidence of cancer, everything possible must be done to prevent transition from precancerous lesions to a fully developed cancer condition. This is made possible by reducing the hazards of constant irritation, infection, and trauma, that, so far as is known at present, are the causative agencies for cancer. To effect this object, the Division of Cancer has joined with medical and quasi-medical societies for the requisite education of the public, and the far-spreading campaign is carried on by means of public lectures, radio talks, and health meetings. Re-

SET-UPS FOR VARIOUS RADIUM TREATMENTS

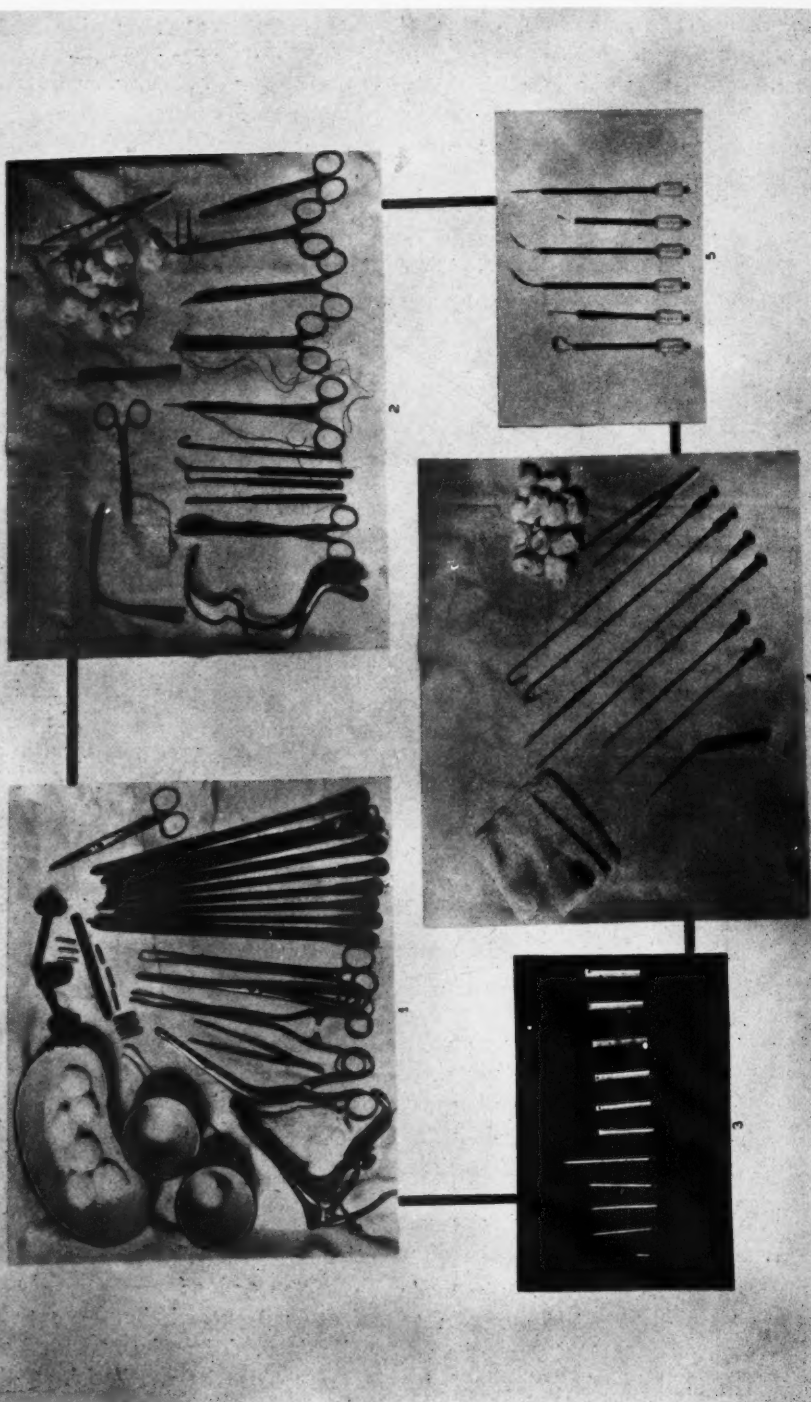


Fig. 19. Instrument set-up used for radium treatment: (1) gynecological; (2) for interstitial radium puncture; (3) the forms in which radium is used—seeds, needles, tubes; (4) instruments used for radon tubules (seeds) implantation; (5) special endotherm cutting electrodes.

METHOD OF TREATMENT OF CARCINOMA OF CERVIX AND RECTUM

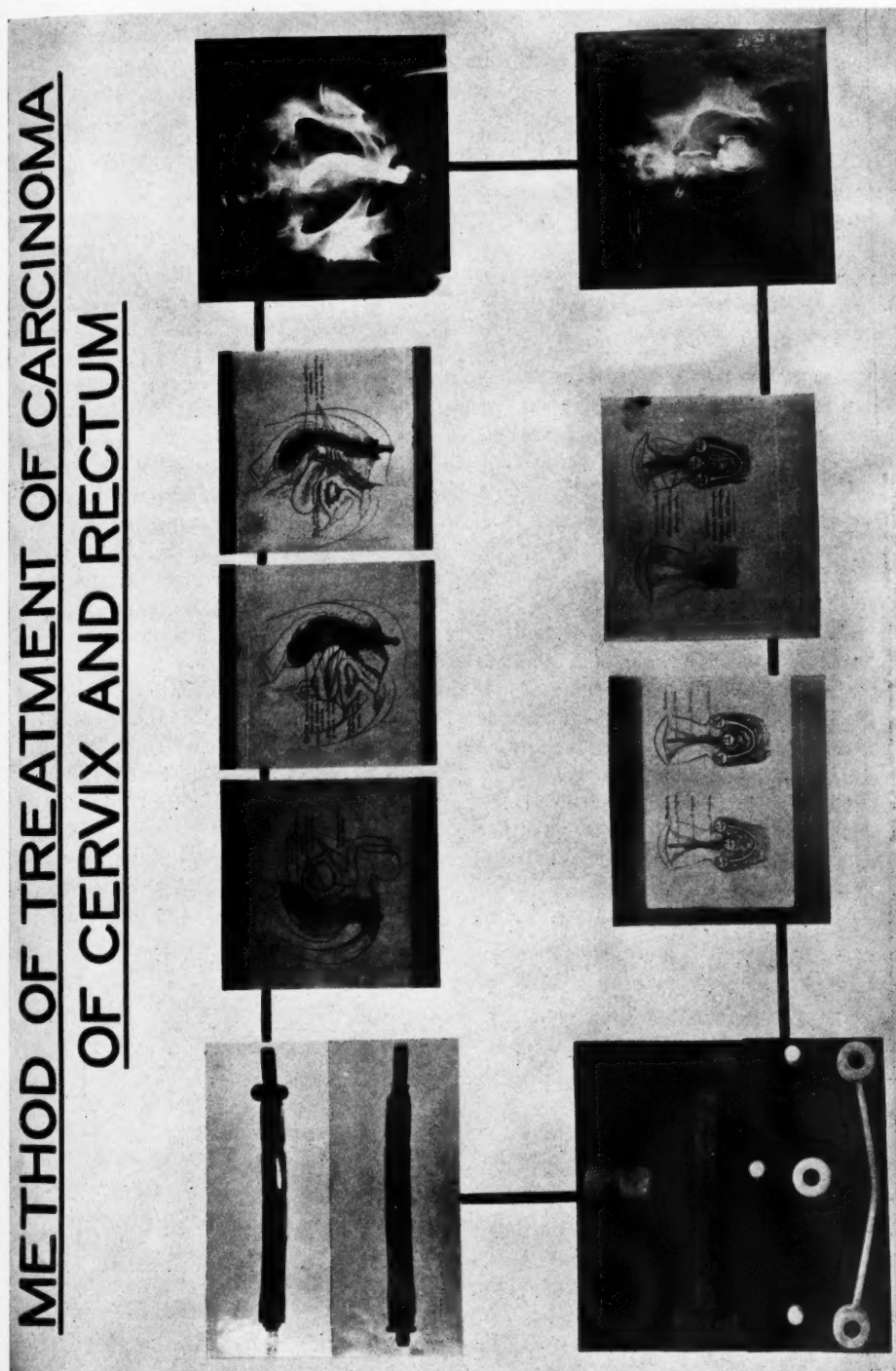


Fig. 20. Cancer of the cervix is best treated by irradiation—a combination of high voltage X-rays through the pelvis and an application of radium to the uterus and vagina is the proper procedure. Special applicators, such as the colpostat, have been devised for the convenient application of radium to the cervix. In the treatment of cancer of the rectum, radium plays an important part. A new device for applying heavily filtered radium to the surface of a malignant lesion in the rectum has proven of value in our work.

sults, while slow, have nevertheless been increasingly gratifying.

To summarize, the City of New York cares for its cancer patients through the Division of Cancer, a bureau of its general hospital system. This Division concerns it-

self with the diagnosis, care, and treatment of cancer patients in hospitals and clinics, and with educating the profession as well as the lay public in cancer work.

The accompanying photographs illustrate some of the activities of this Division.

The Permeability of Cloth Material for the Spectrum of the Sun. W. Möriköfer. *Strahlentherapie*, 1930, XXXIX, 57.

The transparency of twenty-two different types of cloth material for the sun spectrum was studied by means of the cadmium photoelectric cell and by the Michelson-Bimetal actinometer. The transparency of the various materials varied considerably with their texture. It appeared, for instance, that jersey material has a great transparency, while flannel and heavier cloth are almost impermeable. No simple relations could be established between the transparency for light and the weight, the thickness, and the pore volume of the cloth. Boiling decreases or increases the transparency and sometimes does not influence it much. Dyed cloth has less transparency than white cloth. Only the transparency of

artificial silk is increased by the dyeing process. Black cloth transmits less radiation than red or blue cloth. There is no selective absorption for different parts of the spectrum in undyed material. Longer waves are transmitted better by red material, while the shorter waves are better transmitted by blue material; the difference, however, is very slight. It is concluded that the major part of the radiation must pass through the pore openings and that very little is transmitted by the actual material. In addition to the directly transmitted radiation, there is also some diffuse radiation which amounts sometimes to only a small fraction of the direct radiation, except for material of little permeability. The dyeing process leads to a decrease of the transparency for diffused radiation, in some cases as far as complete impermeability.

ERNST A. POHLE, M.D., Ph.D.

ROENTGEN THERAPY OF MEDULLOBLASTOMA CEREBELLI

By F. E. TRACY, M.D., and F. B. MANDEVILLE, M.D.

From the Department of Radiology, Yale University, NEW HAVEN, CONN.

IN 1924, Bailey and Cushing (2) presented a series of twenty-nine centrally placed cerebellar tumors, arising from above the roof of the fourth ventricle and occurring mainly in children. For these tumors, they proposed the term "medulloblastoma," and submitted evidence that they were composed mainly of indifferent cells, analogous to those described by Schaper in the developing cerebrum, and that most of these cells are potential neuroglia. At that time, they concluded that the best method of treatment consisted of a suboccipital decompression followed by persistent roentgen-ray therapy. The technic of this proposed therapy was not outlined in their first paper, which was not actually published until 1925. Bailey, in the same year, individually wrote another paper on the results of roentgen therapy on brain tumors.

Olivecrona and Lysholm (8), in 1926, published excellent notes on the roentgen therapy of gliomas of the brain. One of the tumors reported by them seemed to have all the characteristics of a medulloblastoma and it reacted favorably to radiation.

In 1928, Bailey, Sosman, and Van Dessel (4) outlined a technic of irradiation which they had employed during an eight-year period, in 456 patients with brain tumors. Of these, 222 had been classified as "gliomas" but they limited their considerations to 62 cases, and of these 12 were medulloblastomas. All treatments in their department had been given with an interrupterless 12-inch transformer, mechanically rectified, using 130 to 140 K.V. peak. According to the authors, the filter most often employed was 0.25 mm. of rolled copper, with one thickness of sole leather on the side next to the patient and occasionally 5.0 mm. of aluminum was used in place of the copper.

A distance of 12 inches (30 cm.) from the center of the target to the skin surface, occasionally 10 inches when a shorter duration was expedient, or 16 inches when a more uniform depth dose was required, was used. The portals of entry were delimited by lead rubber on the patient's head and by various lead diaphragms $\frac{1}{4}$ inch thick placed beneath the tube, which was of the broad focus Universal Coolidge type. The authors stated that the portals varied between 8 and 15 cm. in diameter, the milliamperage was 6, and the usual time for a full dose was 25 minutes, which would produce epilation in practically all cases, but only a faint erythema occasionally, appearing in from ten to fourteen days. Such a dose could be repeated at intervals of three weeks, usually with a return of hair several months after the treatments were stopped, and with never more than slight tanning at any time. They included physical data concerning their dose, which we take the liberty to repeat here. The average effective wave length with a Duane ionization chamber was 0.21 Ångström unit as determined by the half absorption method in copper, and an average intensity at 12 inches of from 0.54 to 0.66 electrostatic unit. This gave a single full dose of from 800 to 1,000 electrostatic-unit-seconds, which included the secondary radiation as measured at skin surface. In water phantom, the depth dose with these factors was found to be from 17 to 21 per cent at a distance of 10 cm. below the surface, depending on the size of the portals. Bailey, Sosman, and Van Dessel further stated that the general plan of treatment was to use a single portal, single seance method in post-operative cases, with a trial dose of from 60 to 80 per cent the first day, repeating with 100 per cent doses once every three weeks

if no serious reaction ensued. Most of their cases, they state, received from four to eight such treatments, with a repetition of four more after an interval of from three to six months. The single area treated in each case was directly over the tumor and usually through the operative field, although they state that in deep or midline tumors, bilateral portals were used with 100 per cent of the above dose on each side in two succeeding days. The portals used were always larger than the tumor found or suspected, in order, as the authors explain, to reach it all and to obtain more secondary radiation. Of the 62 gliomas, radium was used only in five cases with varying technics. In their summary, the authors stated their belief that roentgen therapy had been able to retard the growth of medulloblastomas, sometimes for a considerable period, but that it had been unable to destroy them completely or indefinitely to prevent their growth. The fact that the average survival of their treated cases was thirty-four months was considered by Bailey, Sosman, and Van Dessel conclusive evidence of the beneficial effects of radiation.

Up to June, 1929, Bailey (1) had observed 34 new cases of medulloblastoma, in addition to the 29 previously reported in Cushing's collection. In a paper published in 1930, he stated that roentgen therapy was able to prevent local recurrence for long periods of time, and he cited a case in which necropsy showed no local recurrence but extension of the tumor elsewhere. Radiation over the entire spinal canal, in the hope that possible intraspinal extension might be killed before it began to develop, was advocated. Bailey's further experience with medulloblastomas had not altered in any way his conception of their structure or clinical course since his work with Cushing in 1924. In cases in which fairly complete enucleation and intense roentgen-ray therapy were instituted, patients died from intraspinal and intracranial extension. This ex-

tension may occur without operation but it is most frequently noted following operative interference. Bailey's conception is that the neoplastic cells are scattered into the cerebrospinal spaces by the operator, the cells falling by gravity into the spinal canal or being carried upward by the current of fluid over the base of the brain, where they grow as implantation metastases. He believes it advisable to radiate thoroughly the entire cerebrospinal system following operation, in the hope of killing scattered cells before they have time to implant themselves, for, once they have become implanted and give rise to symptoms, a fatal outcome is inevitable. He further points out that roentgen rays, in the doses used, are not supposed to injure the normal nervous tissues or meninges, and that the presence of neoplastic cells in the meshes of the pia-arachnoid gives rise to chronic irritation and proliferation of this tissue, in which condition it may be more sensitive to radiation. He believes that radiation may transform tumor-infiltrated leptomeninx into dense fibrous bands, which may constrict the cord and nerves and diminish the circulation of the blood and block the circulation of the cerebrospinal fluid. We quote the final paragraph of Bailey's paper *verbatim*, as we feel it merits the thoughtful consideration of every careful radiation therapist:

Under these circumstances one might ask whether these patients have not been given too much roentgen treatment. Would it not be better to radiate thoroughly the entire cerebrospinal axis immediately after operation, and then stop? Time and further experience alone can tell.

CLINICAL CASES

During the year 1930 three cases of medulloblastoma cerebelli were referred to us by the Surgical Service of the New Haven Hospital for roentgen-ray therapy. All

had a pre-operative diagnosis of probable medulloblastoma cerebelli, each of which was confirmed at operation by gross appearance of the tumor and later by histologic sections. At present these patients are all living and apparently symptom-free, carrying on the activities in which they were occupied before the onset of their illnesses.

ROENTGEN TECHNIC

All therapy was given with a transformer, mechanically rectified, using an air-cooled Coolidge deep therapy tube. The factors used in our continuous exposure to produce our standard erythema were: 170 kilovolts, 5 milliamperes, 0.5 mm. copper and 2 mm. aluminum, 50 cm. target-skin distance, 50 minutes, with a field of 100 square centimeters. The apparatus was calibrated by physicists only once during the period our patients were under treatment. The chemical method described by Quimby and Downes in 1930 was used, and with the above factors the equipment gave 13 r per minute, or a total of 650 r (in air). Using a field of 100 square centimeters and other factors as given above, the depth dose at 5 cm. was estimated to be 65 per cent and at 10 cm., 32 per cent.

In all three cases 100 per cent of an erythema skin dose was delivered to all portions of the entire cerebrospinal system, and by this we mean 100 per cent E.S.D. depth dosage, obtained by aid of charts advocated by Weatherwax and Widmann (11). In Cases 1 and 2, listed below, 100 per cent E.S.D. each was delivered to the right and left occipital regions, and doses varying from 25 per cent E.S.D. to 100 per cent E.S.D. were delivered to the anterior superior cranial, right and left parietal and cervical, dorsal and lumbar vertebral portals.

After treating Cases 1 and 2 with what amounted to a fractional method except for the intensive doses in the occipital regions,

we consulted independently, Pfahler (10) and Gershon-Cohen (6). Both these radiologists suggested thorough radiation of the entire cerebrospinal axis. Both were in accord in stating that the saturation method as laid down by Pfahler might be used in cases of medulloblastoma cerebelli. The saturation method was pointed out to be especially advantageous in obtaining a 100 per cent depth dose to all portions of the spinal cord where cross-firing is not convenient.

We have listed the total dosages given in Cases 1 and 2 in which the intensive method was used over the primary site (occiput) of the lesions and the fractional method essentially was used over other areas. In Case 3, 50 per cent E.S.D. was used and all areas were brought to 100 per cent E.S.D. and maintained there for one week. The patient returned in three months and was given 50 per cent E.S.D. to all portals, and this was repeated three months later. Possibly we have been entirely too cautious with Case 3, but we are reminded of Bailey's suggestion, "Would it not be better to radiate thoroughly the entire cerebrospinal axis, immediately after operation, and then stop?" Further, it must be kept in mind that after the decompression operation the patient can stand heavy total dosages, but when the decompressive effects are spent, even a 50 per cent E.S.D. delivered over the occipital portal will cause vomiting which will last for days. This was our experience with Case 2.

We cannot stress too strongly the point that thorough roentgen therapy must not be attempted without a suboccipital decompression, and, secondly, that the effects of a decompression do not last for long, and vary in different cases.

CASE REPORTS

Case 1. A female, aged 13 years, was admitted to the Surgical Service of the New Haven Hospital on July 18, 1929. The past history until two months before admission

was negative, at which time she began to have fronto-occipital headaches. Two weeks before admission she began to have slight blurring of vision, diplopia, projectile vomiting, and slight unsteadiness of gait. The above symptoms increased in severity and confined the patient to her bed for one week previous to her entrance to the hospital. The essential positive findings on neurological examination were: Bilateral papillo-edema, left internal strabismus, positive Romberg to the right and equivocal left Babinski. The pre-operative impression was a fourth ventricle medulloblastoma. On July 22, 1929, a cerebellar exploration was done by Dr. Harvey, revealing a tumor of the fourth ventricle. On August 6, 1929, a second operation was done and a partial extirpation of the tumor mass was made. The patient was discharged from the hospital August 29, 1929, much improved. She returned for roentgen-ray therapy December 19, 1929, receiving deep roentgen therapy for a period of fourteen months with no untoward effects and apparently no recurrences of symptoms. The areas treated, with total percentage to each area, are as follows:

Anterior superior parietal region..	100 per cent
Left parietal region.....	100 per cent
Right parietal region.....	175 per cent
Posterior occipital region (left).....	400 per cent
Posterior occipital region (right).....	405 per cent
Nape of neck and cervical spine	
(left)	325 per cent
Nape of neck and cervical spine	
(right)	320 per cent
Upper dorsal region.....	450 per cent
Lumbar spine.....	250 per cent

Case 2. A female, aged 6 years, was admitted to the Surgical Service February 18, 1930, complaining of vomiting, headaches, and unsteadiness of gait. These symptoms began seven months previously and, more recently, there had been some blurring of vision. The positive findings on neurological

examination were: Bilateral papillo-edema, horizontal nystagmus of cerebellar type, slight bilateral adiadokocinesia, hypotonia, unsteady gait, and broad base stance. The pre-operative impression was of a medulloblastoma arising in the roof of the fourth ventricle and involving the cerebellum. On February 22, 1930, the cerebellar fossa was explored by Dr. German and a large tumor mass was found in the left cerebellar hemisphere extending medially into the fourth ventricle. It was partially extirpated. The first cycle of deep roentgen therapy was given between March 11 and 20, 1930, and the patient was discharged from the hospital March 21, 1930, much improved. During the course of the next twelve months the patient returned to the hospital at intervals for deep roentgen-ray therapy. The following areas were treated with the total percentages given below. There has been no return of symptoms.

Anterior superior parietal region..	60 per cent
Left parietal.....	110 per cent
Right parietal.....	110 per cent
Posterior occipital region (left).....	200 per cent
Posterior occipital region (right).....	200 per cent
Nape of neck and cervical region	
(left)	345 per cent
Nape of neck and cervical region	
(right)	320 per cent
Upper dorsal region.....	410 per cent
Lower dorsal and lumbar spine.....	275 per cent

Case 3. A male, aged 15 years, was admitted to the Surgical Service October 1, 1930, complaining of headaches, projectile vomiting, blurring of vision, and unsteady gait. The onset of symptoms was in July, 1929, when the patient first began to have headaches. Since then the above symptoms developed and progressed in severity until the patient became confined to bed (one month before entrance to the hospital). The essential findings on examination were: Bilateral papillo-edema, right external rectus

weakness, nystagmus to gaze in all directions with quick component most marked to left, hypertonia of right upper extremity, ataxia, Romberg positive to right and adiadokocinesia right. The pre-operative diagnosis was medulloblastoma involving the roof of the fourth ventricle and the right hemisphere of the cerebellum. A suboccipital decompression was done by Dr. German on October 6, 1930, with partial removal of a fourth ventricular tumor involving also the right cerebellar hemisphere. On October 20, 1930, deep roentgen therapy was begun. The usual areas were treated by the saturation method, as introduced by Pfahler, for a one-week period, so that the dosage was kept at 100 per cent E.S.D. over each area during this time. The areas thus treated on the skull measured 10 by 10 cm. approximately, and those over the spine 18 by 5 cm. approximately. The patient was discharged November 6, 1930, greatly improved. He returned January 16, 1931, for more deep roentgen therapy and was given a 50 per cent dose to each portal, and this procedure was repeated three months later, making the total dosage for each area as given below. At no time did the patient show any untoward effects from his roentgen therapy and on his last visit it was noted that the hair over his entire scalp had regrown.

Anterior superior skull.....	250 per cent
Posterior occipital and cervical spine	250 per cent
Right lateral skull.....	225 per cent
Left lateral skull.....	225 per cent
Dorsal spine.....	250 per cent
Lower dorsal and lumbar spine.....	257 per cent

The areas given above seem most satisfactory for treatment of brain tumors—primary or metastatic. We have used this method routinely in our latest cases, including a fourth case of medulloblastoma, with good immediate results. The ultimate results must be determined at a future date,

and this paper should be considered as a preliminary report.

SUMMARY

1. Our object is to again bring to the attention of radiologists the work of Bailey and Cushing on the medulloblastomas, the more important part of which remains hidden in the neurologic and pathologic literature.

2. Medulloblastomas are usually centrally placed cerebellar tumors arising in the region of the roof of the fourth ventricle and occur mainly in children. They are so common in pre-adolescence that when a child has unexplained vomiting, shows a possible enlargement of its head, and gives a story of periodical unsteadiness, it is well to be on guard and look at the eye grounds frequently.

3. A suboccipital decompression should always precede roentgen therapy, and the beneficial effects vary tremendously in duration.

4. The advisability of suboccipital decompression alone, or, in addition, partial or total extirpation of the tumor, is a surgical and not a radiological problem in each individual case.

5. Thorough deep roentgen therapy over the entire cerebrospinal system should follow operation. A minimum total depth dosage of 100 per cent E.S.D. to all parts of the cerebrospinal system is indicated.

6. After the first complete cycle of roentgen therapy, the saturation method or a complete repetition of the cycle, two, three, or four times may be indicated during the first twelve months, according to the individual case.

7. The radiologist should exercise great caution in attempting to continue the roentgen therapy for too long a period, as the tumor cells probably become radioresistant and further radiation may damage surrounding tissues and adjacent organs.

BIBLIOGRAPHY

- (1) BAILEY, PERCIVAL: Further Notes on the Cerebellar Medulloblastomas: The Effect of Roentgen Radiation. *Am. Jour. Path.*, March, 1930, VI, 125-136.
- (2) BAILEY, PERCIVAL, and CUSHING, HARVEY: Medulloblastoma Cerebelli: A Common Type of Midcerebellar Glioma of Childhood. *Arch. Neurol. and Psychiat.*, August, 1925, XIV, 192-224.
- (3) BAILEY, PERCIVAL, and CUSHING, HARVEY: A Classification of the Tumors of the Glioma Group on a Histogenetic Basis, with a Correlated Study of Prognosis. *J. B. Lippincott Co.*, Philadelphia, 1926.
- (4) BAILEY, PERCIVAL, SOSMAN, MERRILL C., and VAN DESSEL, ARTHUR: Roentgen Therapy of Gliomas of the Brain. *Am. Jour. Roentgenol. and Rad. Ther.*, March, 1928, XIX, 203-264.
- (5) CUSHING, HARVEY: The Intracranial Tumors of Preadolescence. *Am. Jour. Dis. Child.*, April, 1927, XXXIII, 551-584.
- (6) GERSHON-COHEN, JACOB: Personal communication.
- (7) HYSLOP, G. H., and LENZ, M.: Radiation Treatment of Glioma of Brain. *Am. Jour. Med. Sci.*, July, 1928, CLXXVI, 42-61.
- (8) OLIVECRONA, H., and LYSHOLM, E.: Roentgen Therapy of Gliomas of the Brain. *Acta Radiologica*, 1926, VII, 259-268. (Cited by Bailey in Reference (1), above.)
- (9) PANCOAST, HENRY K.: Experience in the Treatment of Brain Tumors by Irradiation during the Past Thirteen Years. *Am. Jour. Roentgenol. and Rad. Ther.*, January, 1928, XIX, 1-15.
- (10) PFAHLER, GEORGE E.: Personal communication.
- (11) WEATHERWAX, JAMES L., and WIDMANN, BERNARD P.: Physical Factors in Radiation Therapy and Their Clinical Application. *RADIOLOGY*, April, 1929, XII, 297-308.

The Rôle of Roentgenology in Psychiatry.
M. J. Hubeny. *Clin. Med. and Surg.*,
March, 1931, XXXVIII, 191.

A short discussion is presented concerning the new studies of the causes of insanity. The use of information obtained from the roentgenologic examination and the treatment of such cases are described. Thyrotoxicosis, the climacteric, uterine fibroid, thymic disease, dystrophia, adiposo-genitalis, and other allied anatomic and physiologic conditions are mentioned. An effort is made to stimulate more observations so that proper consideration may be given the insane.

A. O. HAMPTON, M.D.

Roentgen Diagraphic Examination of Muscle Contraction. Gundob Boehm. *Med. Klinik*, Sept. 12, 1930, XXVI, No. 37, p. 1372.

Roentgendiagraphy is a means of showing the spacing of the molecules and their changes in biological objects. This method shows a characteristic system of points or

lines on a film, when a small bundle of X-rays of definite wave length passes through a given substance. A crystal gives a point diagram, according to Laue; a crystal-powder gives a line diagram. The muscle gives also a characteristic diagram. Comparison between roentgen diagrams of muscles of turtles before and during contraction shows marked differences, indicating a definite change in the molecular structure. Further studies along this line may be of importance in the physiology of muscle contraction.

H. W. HEFKE, M.D.

Davos. A. Jesionek. Strahlentherapie,
1930, XXXIX, 1.

This article, the first in a volume, dedicated to C. Dorno, offers a concise analysis of the climatic factors of Davos and their curative effects. The beneficial results obtained in tuberculosis are, in the author's opinion, mainly due to the Alpine sun, which is very rich in the ultra-violet part of the spectrum.

ERNST A. POHLE, M.D., Ph.D.

RESULTS OF IRRADIATION TREATMENT OF MYOMA OF THE UTERUS

BASED ON A STUDY OF 318 CASES

By BERNARD F. SCHREINER, M.D., F.A.C.S.
State Institute for the Study of Malignant Disease, BUFFALO, N.Y.,
Burton T. Simpson, M.D., Director.

IT is not the purpose of this paper to discuss the different forms of treatment for fibroids of the uterus, but, rather, to lay stress on the proper irradiation and the results obtained therefrom.

There has been much controversy between the gynecologist and the radiologist about the proper course of treatment of very large myomas. The gynecologist holds that a tumor larger than a four-months pregnancy should be subjected to surgery, while the exceptions to this rule are common in the hands of many competent radiotherapists. The surgical treatment of the myoma and the control of the bleeding by hysterectomy have well known indications which from the surgical point of view are well recognized. The results of treatment are definite. The operative mortality, in good hands, is from 1 to 5 per cent. The morbidity is a factor which often is disregarded by the gynecologist but is a potent factor to the patient and the physician. There are, without doubt, cases that can be handled to better advantage by surgical intervention, but the value of irradiation is very definite, having advantages of no loss of time and no mortality.

In our series of cases, the fibroids varied from about twice the size of a normal uterus, nodular, up to the size of an eight- to nine-months pregnancy. About 92 per cent of the growths occurred in the body of the uterus, only 8 per cent in the cervix. All varieties and combinations were observed; submucous, interstitial, and subserous, a few of the latter being pedunculated.

Ewing (1) says that 50 per cent of women at the age of 50 have fibroids, 20 per cent at the age of 35, and 38 per cent be-

tween the ages of 30 and 40, and quotes Klob and Gusserow as authority. He holds that:

The essential factor in the etiology of myoma is an embryogenic disturbance in the structure of the uterus. The remarkable degree of isolation of many myomas, their widespread occurrence apart from the uterine body, and the presence in many cases of heterotopic inclusions, epithelial, cartilaginous, osseous, fatty, and rhabdomyomatous, clearly point to an embryonal origin. Moreover, as Williams has emphasized, uterine myomas are often associated with a large number of abnormalities in the genito-urinary system.

The nature of the embryogenic disturbance varies with different tumors.

(a) It is generally agreed that the common pure fibromyoma results from a disturbance in the formation of the tubes, uterus, and vagina from the müllerian ducts, which split off from the wolffian ducts at an early period, and fuse to form the genital canal.

The relation of certain early myomas to the blood vessels of the uterus has long impressed many observers, and suggested that uterine myomas arise from disturbances in the growth of the blood vessels, from the walls of which the uterus and vagina originally receive their muscular tissue. Rosger, Kleinwachter, Sobotta and others have traced the development of early myomas from the vessel walls, and concluded that the blood vessels control the origin and growth of uterine myomas.

There are many who believe the origin of myomas is due to perivascular growths.

(b) Regarding the origin of adenomyomas opinions are at variance, and it is probable

that no single mode of origin can apply to all these tumors.

Origin has been suggested in: (1) müllerian body; (2) wolffian body.

Summarizing the evidence, one may conclude that simple myoma uteri arises chiefly from a disturbance in the development of the tubes, uterus, and vagina from Müller's ducts, which often leads at the same time to gross deformities and infantile characters in these organs.

Adenomyoma arises chiefly from the fetal or post-embryonal inclusion of müllerian epithelium in the tumor process. . . . The chief exciting factor is intermittent hyperemia connected with irregularities in the sexual functions.

In a recent paper by Nakuschkin (2), "The Etiology and Prophylaxis of Myomas of the Uterus," some very interesting data were obtained by an analysis of 688 cases of patients suffering from myoma of the uterus. He states that in myoma patients there is a great potential energy of the ovary in the form of increased follicular activity, with simultaneous absence of reproduction in the uterus. He says:

From this comes the natural conclusion that the uterine myoma is a pathological reaction to the ovarian impulse which replaces the normal, physiological reaction of pregnancy. . . . One comes in this fashion to the general pathogenetic assumption for uterine myomas: The myoma of the uterus is the menstrual product of sterile women with high reproductive potency.

This author finally concludes that fibroids are probably due to an excessive secretion of the follicular hormone.

It is a well known fact that fibroids have disappeared after double oöphorectomy, so that the etiology of fibroids may be due to a dysfunction of internal secretions.

Young and Williams, as quoted by Lockyer (3), give 10.5 per cent as the average sterility of women who have reached the age of 38, and Cullen observes that in women with fibroids 33 per cent are sterile.

The number of pregnancies in our series of cases is shown in Table I. It will be noted that only 9.2 per cent were sterile; of course, 15 per cent were single. The largest number of pregnancies was 16; 55.1 per cent (of 270 married women) had more than three pregnancies.

A diagnosis of myoma of the uterus may be made when the tumor mass in the uterus varies from the size of a hazel nut to the size of a seven- or eight-months pregnancy, is nodular and hard, and any of the following symptoms are present: excessive bleeding, at times associated with anemia; pressure symptoms which may cause frequency of urination or constipation; backache; gastro-intestinal disturbances, or even asthenia and neurosis in some cases.

Pain and tenderness are indicative of inflammatory disease of the adnexa or of degenerative processes in the myoma. It is important that the degenerative changes, such as atrophic, hyaline, cystic, fatty, calcareous, and necrobiotic, be kept in mind, and that in the cases of profound anemia, in which the loss of blood does not explain the low hemoglobin and total red count, some of the degenerative changes may lead to complications if they are irradiated. Calcification or symptoms of vascular disturbances, such as torsion, are also contra-indications to irradiation.

The importance of eliminating the possibility of a co-existing pregnancy must always be borne in mind. Early in pregnancy the Aschheim-Zondek (4) test may be of value. In the later months of pregnancy the fetus can be shown radiographically. Whenever there is doubt as to the possibility of an existing pregnancy it is better to wait a month, or several months if neces-

sary, rather than to irradiate a fetus. Murphy (5) has shown pretty conclusively that these children are injured, the majority of them being born microcephalic. On the other hand, a dose of roentgen ray or radium, making approximately 60 per cent of the erythema dose, may cause death of the fetus, and abortion.

The records of our tumor clinic show that about 16 per cent of all admissions in the gynecological department were myomas. Eleven of these cases showed a positive Wassermann reaction; three had a positive Neisser reaction. The negro race has a higher incidence of fibroids, but in our series only seven were colored women. Fibroid is exceedingly rare before the age of twenty. Table II shows the age incidence of fibroid in our series: 4.4 per cent were 30 years or younger; 66.4 per cent, 30 to 50 years of age; 29.2 per cent were outside the years of sexual activity, when the uterus is not capable of bearing. Our youngest patient was 22 and it will be noted that she was not treated; the oldest was 78 years of age.

Gauss and Lembcke (6) were among the pioneers in the treatment of fibroids and menorrhagia by means of irradiation. Their work consisted of roentgen treatment and their dosage and results were carefully worked out. It seems that the wave of enthusiasm has spread over the Continent of Europe and more recently to this country. There is no longer any doubt but that irradiation is of value and has its place in the treatment of fibromas. It remains for the workers in this field to publish their results from accurate observations as to the clinical findings, and the results that can be expected anatomically. Contributions on the subject of irradiation of myomas by Kelly (7), Burnam (8), Neill (9), Schmitz (10), Clark and Norris (11), Stacy (12), Wood (13), Donaldson (14) and many others have added to our knowledge of irradiation in this disease.

TREATMENT

Treatment, consisting of external radiation by high voltage roentgen ray at 80 cm. distance; filter 0.5 mm. copper, 1 mm. aluminum; size of field 20×20 cm.; two fields, one anterior and one posterior, was administered in two or four sittings on successive days. There was little, if any, disturbance, such as nausea, vomiting, or loss of time, from this method. The factors varied according to the thickness of the patient, an effort being made to put from 40 to 50 per cent in the ovaries and tumor mass. The same factors were used for "temporary sterilization" in which 28 to 35 per cent was administered to the tumor and the ovaries. This was particularly applied to patients below the age of 35, in whom an effort was made to control bleeding and to cause diminution in the size of the tumor, with the hope that menstruation would re-establish itself. In some instances radium packs were used at 6 cm. distance, field 6.5×7.5 cm., with filter of silver 0.5 mm., brass 2 mm., aluminum 1 mm., rubber 1 cm., using two or three fields through the lower abdominal wall. At this distance 17 per cent was administered at 10 cm. depth. Radium tubes were usually used in tandem, inserted in the body of the uterus, filtered through 0.5 mm. gold, 0.5 mm. brass, and 1 mm. rubber, varying, according to the size of the tumor and the distance of the tubes from the ovaries, from 600 to 800 mg.-hrs. of radium up to 1,600 milligram-hours.

In cases recorded here as having been treated by a combination of radium and external radiation, radium was inserted and allowed to remain for periods of from 1,200 mg.-hrs. to 1,600 mg.-hrs., and the total dose supplemented by 25 per cent of the skin dose in the ovary, administered by high voltage roentgen ray. These treatments were administered at the time of the curettage, which was precautionary, so that

malignancy of the fundus would not be overlooked.

RESULTS

Of these 318 patients, 34 were not treated, and 284 were treated as follows:

90 cases were treated by the insertion of radium and high voltage roentgen ray.

90 cases were treated with radium tubes.

96 cases were treated by external irradiation (radium packs or high voltage roentgen rays).

8 cases were treated by myomectomy (submucous fibroids) and irradiation.

Eleven cases were lost track of immediately after treatment. Nine had no bleeding symptoms.

Of the 90 patients treated with radium and roentgen ray, 98.9 per cent stopped bleeding; however, one had a return of symptoms in two months and was subjected to hysterectomy elsewhere. This case might have shown better results if hysterectomy had been postponed for a few months. There was diminution in the size of the tumor in 71.4 per cent of these cases.

Of the 90 cases treated by the insertion of radium tubes, all, or 100 per cent, stopped bleeding. Diminution in the size of the tumor was noted in 89.8 per cent of these cases.

Of the 96 cases treated by external irradiation (radium packs or high voltage roentgen ray), 96.5 per cent stopped bleeding. One of these had a return of bleeding in one year and had to be subjected to further irradiation but has been well since. There was diminution in the size of the tumor in 75 per cent of these cases.

Considering the results of irradiation as a whole, in our series of cases, bleeding ceased in 98.5 per cent, in the majority of them at once. However, in five cases menstruation continued for from one year to one and a half years before cessation. Menstruation was re-established in 13 cases after "temporary sterilizing" doses. The follow-

ing are the results in these cases: Three of the patients were between the ages of 26 and 29—in all there was reduction in the size of the fibroid; menstruation was re-established immediately in one case; in six months in another, although she had to be given a full dose after two and a half years on account of the recurrence of profuse bleeding, and in the third normal menstruation was re-established in one year. Seven of the cases were between the ages of 30 and 35—in five of these the uterus returned to normal size, and normal menstruation was re-established in from six to eight months; in one, normal menstruation was re-established but the fibroid, which was very large, remained the same size; in another there were two periods three years after treatment. Three cases were 41 years of age—in one, normal menstruation was re-established after three months, then the periods became prolonged and the patient was subjected to further irradiation, too recent to permit of reporting the effects; menstruation became normal in the other two cases in one and one-half years; in one, the tumor was smaller; in the other the uterus remained only slightly larger than normal.

Diminution in the size of the tumor was noted in 85.4 per cent of all the cases, including all tumors.

It is true that the control of bleeding and regression of the tumor were most marked in those cases treated by intra-uterine radium application, but it is only fair to say that these tumors were, on the average, smaller than those submitted to a combination of radium and roentgen ray, or to external irradiation alone. Many of the largest tumors were subjected to external irradiation alone.

Of the 284 cases irradiated, surgery was resorted to in 11 on the advice of some other physician, because of the persistence of the tumor in six instances, and because of recurrence of bleeding in five cases—after

three months in one case, and in from three to three and a half years in four cases.

Menopausal symptoms—neurosis, hot flashes, sweating—do not seem to be any more severe after irradiation than in the average menopause, with a few exceptions.

In eight cases reported here, submucous myomas, which were present in cases with interstitial and subserous masses, were removed through the vagina, and radium then applied. These submucous growths varied from 6 cm. up to 15 cm. in diameter. Of these eight cases treated by myomectomy and irradiation, seven stopped bleeding within a month, one had two periods and then ceased. Three of the tumors were pedunculated and in two cases there were multiple myomas present also. These uteri returned to normal size.

It is the writer's belief that a closer association between the gynecologist, the radiologist, and the physicist will be conducive to a more accurate estimation of the value of irradiation in the treatment of myomatous tumors. One has only to follow the literature to see the great variations in technique in applying radium or roentgen ray in the treatment of this disease. It is not understood, apparently, that there is little, if any, difference in the control of myomatous lesions, whether by radium or roentgen rays; that the primary effect of irradiation is on the ovary, the secondary effect directly on the myomatous tissue.

A more careful selection of the cases for irradiation, especially with radium, should be encouraged, particularly when there is a suspicion of an associated malignancy in the fundus. It is essential that the physics of this agent be thoroughly understood. One finds that doses of radium, from 600 to 700 mg.-hrs., up to 2,400 mg.-hrs., are given by various operators for the control of this disease. It is easy for the casual observer who is not acquainted with the facts to do damage by leaving a single tube in a certain posi-

tion in the uterus for from 2,000 to 2,400 mg.-hrs., not keeping in mind that one author uses platinum of 1 mm. thickness, another uses lead of 2 mm. thickness with rubber immediately surrounding the tube. Greater accuracy in the description of the tubes, *i.e.*, length, amount of radium contained, thickness of the capsule, size of the tumor and so forth, all are problems which have to be taken into consideration.

It will be seen that many of the contraindications which are set up by the gynecologist can be overcome if these physical principles are kept in mind. For example, myomatous uteri, the size of a six- to eight-months pregnancy, without any degenerative inflammatory changes, can be, in selected cases, taken care of by external irradiation alone. I have seen such tumors atrophy so that the remnants of the growth were about the size of a three-months pregnant uterus. This type of case would not be suitable for intra-uterine application of radium. Even submucous fibroids can be so influenced by external irradiation alone that a good result is obtained. On the other hand, submucous fibroids presenting in the vagina or cervix would better be treated by removal of the fibroid, followed by the application of radium in the uterus, or external irradiation following the removal. Associated lesions, such as ovarian cysts, salpingitis, circulatory disturbances in the tumor, calcified tumors, or some of those showing marked degenerative process, would naturally best be treated surgically.

It is of importance, too, not to overlook associated malignancy. However, in our series only nine cases were observed associated with fibroid—five of fundus carcinoma, three of epithelioma of the cervix, and one of carcinoma of the ovary. In our entire series of 1,993 gynecological cases, as we have said, 318 were fibroids, while only 11 were malignant myomas. From these figures one can readily see that malig-

nant myoma is not a common disease, and that the tendency of myoma to become malignant is not great. All of our cases of malignant myoma were post-operative, and all but one, that was treated prophylactically, had recurred (15).

TABLE I.—SHOWING PREGNANCIES IN THIS

SERIES OF CASES	
No. pregnancies	No. incidences
Single	48
0	25
1	44
2	48
3	52
More than three	101
	318

TABLE II.—SHOWING THE AGE INCIDENCE
AT THE TIME OF ADMISSION

Age	Not treated	Treated	Total
22-24	1	..	1
25-29	1	8	9
30-34	1	15	16
35-39	4	34	38
40-44	6	71	77
45-49	11	73	84
50-54	5	50	55
55-59	2	12	14
60-69	1	16	17
70-78	2	5	7
Total	34	284	318

CONCLUSIONS

1. Irradiation treatment in myoma of the uterus has a very definite place in gynecology.

2. The bleeding is controlled in from 96 to 100 per cent of the cases.

3. The size of the tumor is definitely influenced in 85 per cent of the cases treated, there being regression to normal or at least a diminution to 50 per cent of the original size.

4. Of the cases reported, 98.5 per cent were symptomatically well. The menopausal symptoms—neurosis, hot flashes,

sweating—do not seem to be any more severe after irradiation than in the average menopause, with a few exceptions.

BIBLIOGRAPHY

- (1) EWING, JAMES: Neoplastic Diseases. W. B. Saunders Company, Philadelphia, 1928, pp. 229-233.
- (2) NAKUSCHKIN, N.: The Etiology and Prophylaxis of Myomas of the Uterus. Zentralbl. f. Gynäk., Nov. 15, 1930, LIV, 2899-2909. Abst. Internat. Surg. Digest, February, 1931, XI, 124-127.
- (3) LOCKYER, CUTHBERT: Myoma. Practice of Surgery, Dean Lewis. W. F. Prior Company, Inc., Hagerstown, Maryland, 1928.
- (4) ASCHHEIM, S.: The Early Diagnosis of Pregnancy, Chorionepithelioma and Hydatidiform Mole by the Aschheim-Zondek Test. Am. Jour. Obst. and Gynec., March, 1930, XIX, 335-342.
- (5) MURPHY, DOUGLAS P.: Ovarian Irradiation and the Health of the Subsequent Child. Surg., Gynec. and Obst., June, 1929, XLVIII, 766-779.
- (6) GAUSS, C. J., and LEMBCKE, H.: Röntgentiefentherapie. Urban & Schwarzenberg, Berlin, 1912.
- (7) KELLY, HOWARD A., and CULLEN, THOMAS S.: Myomata of the Uterus. W. B. Saunders Co., Philadelphia, 1909.
- (8) BURNAM, CURTIS F.: Report of Some Observations of Effects of Radium Therapy in Cases of Large Uterine Fibroids. Am. Jour. Obst. and Gynec., 1924, VIII, 411-415.
- (9) NEILL, WILLIAM, JR.: A Review of the Treatment of Uterine Fibroids, with Special Reference to the Use of Radium. Am. Jour. Roentgenol. and Rad. Ther., April, 1929, XXI, 332-336.
- (10) SCHMITZ, HENRY: The Indications for Radiation Therapy in Benign Uterine Hemorrhages. Am. Jour. Roentgenol. and Rad. Ther., April, 1929, XXI, 327-331.
- (11) CLARK, JOHN G., and NORRIS, CHARLES C.: Radium in Gynecology. J. B. Lippincott Co., Philadelphia, 1927.
- (12) STACY, LEDA J.: The Treatment of Benign Conditions of the Pelvis with Radium. Am. Jour. Roentgenol., October, 1922, IX, 658-662.
- (13) WOOD, FRANCIS CARTER: Roentgen Treatment of Uterine Fibromyomas. Jour. Am. Med. Assn., March 1, 1930, XCIV, 601-606.
- (14) DONALDSON, MALCOLM: Radium in the Treatment of Menorrhagia and Irregular Uterine Hemorrhage. British Med. Jour., Nov. 15, 1930, p. 18: abstracted in RADIOLOGY, March, 1931, XVI, 408.
- (15) SCHREINER, BERNARD F.: A Clinical Study of Eight Cases of Myoma Malignum. Surg., Gynec. and Obst., June, 1929, XLVIII, 730-732.

CONDITIONS WHICH RESULT IN COLLAPSE OF THE LUNG¹

By R. P. POTTER, M.D., Marshfield Clinic, MARSHFIELD, WISCONSIN

SOME of the conditions under which an entire lung, a lobe of a lung, or a part of a lobe is found to be airless are (1) atelectasis of the newborn, (2) plug-

ly plugged by a foreign body or a tumor of a bronchus the alveolar air in the lung is quickly absorbed by the circulation and the lung is in a state of collapse against the

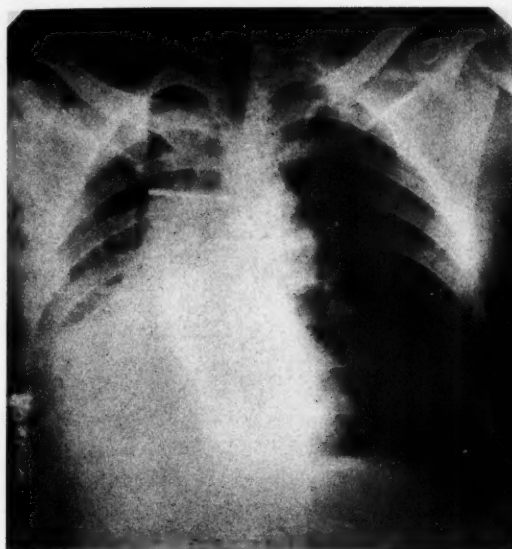


Fig. 1-A. Case 1. Post-operative massive collapse of right lower lobe following left inguinal herniotomy under novocain.



Fig. 1-B. Case 1. Film made two hours after turning patient on left side. Right lung is completely reinflated.

ging of a bronchus by a foreign body or a tumor of a bronchus, (3) pleural effusion, hemothorax, pneumothorax, intrathoracic tumor, or (4) idiopathic massive collapse.

(1) Roentgenologic studies of the chest of the newborn shortly after birth frequently show small areas of lung which have not yet become inflated. These atelectatic areas usually become fully expanded within a few days.

(2) When a bronchus becomes complete-

ly plugged by a foreign body or a tumor of a bronchus the alveolar air in the lung is quickly absorbed by the circulation and the lung is in a state of collapse against the chest wall, the heart and trachea displaced toward the affected side, and the diaphragm elevated.

(3) Pleural effusion, hemothorax, pneumothorax, and intrathoracic tumors cause a certain amount of collapse of lung due to pressure and may also cause displacement of mediastinal contents, but when there is displacement it is toward the uninvolved side.

(4) Idiopathic massive collapse is a condition in which a previously normally aerated lung suddenly becomes airless without any apparent cause.

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1-5, 1930.

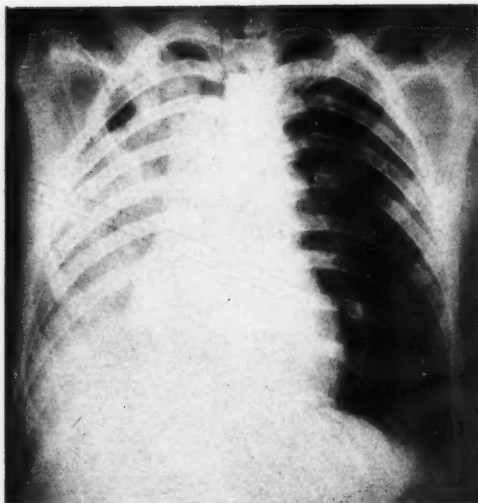


Fig. 2-A. Case 2. Post-operative massive collapse of right lung following appendectomy (gangrenous appendix), under ether anesthesia.

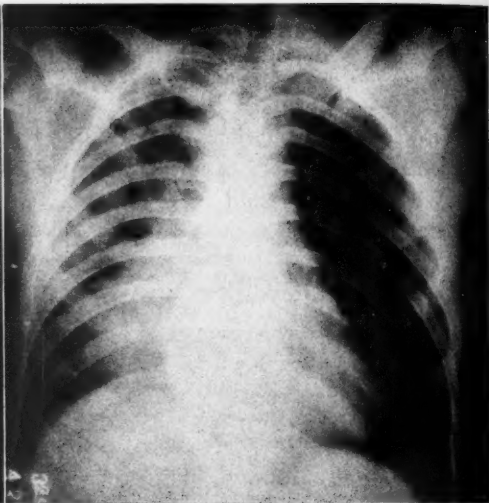


Fig. 2-B. Case 2. Film made twenty-four hours after turning patient on left side. Heart and trachea in normal positions and lung nearly completely reinflated.

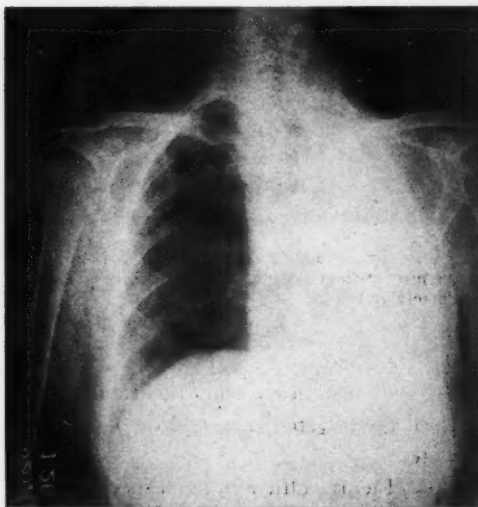


Fig. 3-A. Case 3. Mrs. B. R., Jan. 26, 1929, left lung collapsed, heart and trachea displaced to the left, carcinoma of left bronchus.

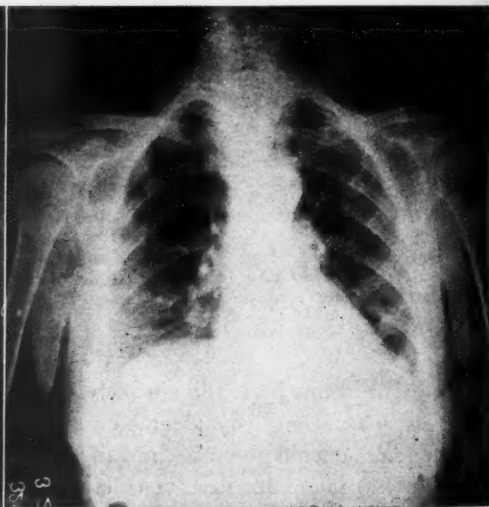


Fig. 3-B. Case 3. March 25, 1929, lung completely reinflated following bronchoscopic examination.

I will confine my discussion to massive collapse, collapse due to tumor of a bronchus, and collapse in pneumothorax.

Massive collapse has been defined by John Rose Bradford (1) as "an unusual condi-

tion in which the lung, without the presence of any gross lesion, such as bronchial obstruction, pleural effusion, etc., interfering with the free entry of air, becomes airless to a greater or less degree."



Fig. 4-A. Case 3. May 21, 1929, left lung again partially collapsed.

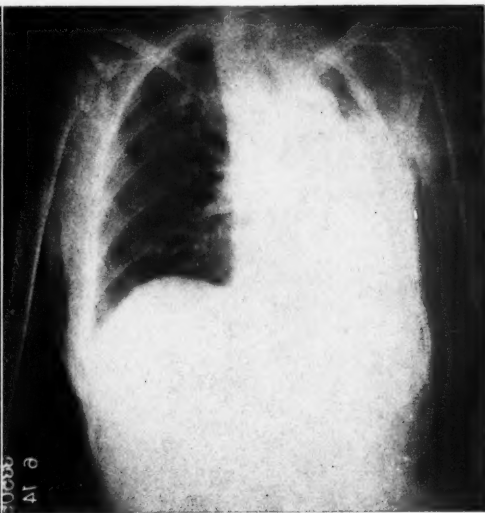


Fig. 4-B. Case 3. June 14, 1929, collapse nearly complete.



Fig. 5-A. Case 3. June 25, 1929, upper portion partially expanded again, following bronchoscopy on June 19.

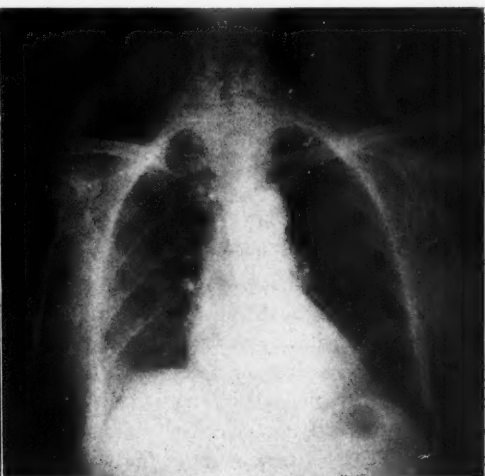


Fig. 5-B. Case 3. July 13, 1929, left lung again fully inflated, heart and trachea in normal positions.

Neither its etiology nor mechanism has yet been explained to our entire satisfaction. In 1890 W. Pasteur (2), an English physician, first introduced the term "massive collapse" into medical literature, and in 1908 reported finding collapse of lungs at autopsy

on children who had died of diphtheria and who had had paralysis of the diaphragm. He considered this paralysis a causative factor of collapse. We know that phrenicotomy causes paralysis of the diaphragm but does not cause collapse of the lung.

Many cases have been reported in recent years and many theories advanced as to the probable cause or causes of its occurrence. Scott and Joelson (3) have advanced the opinion that posture may be a factor, and

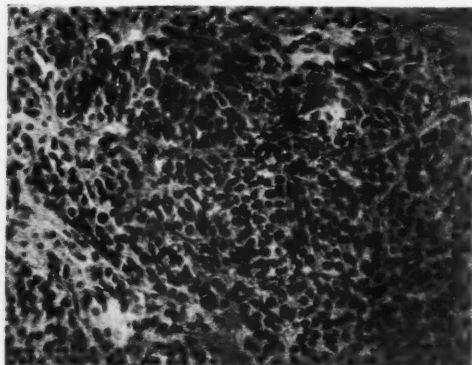


Fig. 5-C. Case 3. Photomicrograph of tumor of bronchus. Highly differentiated cells supported by a minimal stroma indicating a highly malignant growth.

cite the case of a patient with bilateral kidney stones who was twice operated on, each operation being followed by collapse of the opposite lung. Sante (4) says:

It seems most logical to suppose from the available evidence that massive atelectatic collapse of the lung results from a simultaneous inhibition of the cough reflex by some toxic or reflex stimulus in association with an impairment of the respiratory function, either immobilization of the respiratory muscle from a defence reaction or paralysis from toxic neuritis. This in turn permits the accumulation of secretions, blocking the bronchi, which results in atelectasis. Posture favors the development in the most dependent portion. Occurring alone, any one of these factors alone may not be sufficient to produce the condition; their simultaneous occurrence, however, may be all that is necessary to result in collapse.

The two cases I wish to report occurred in entirely different conditions throughout

except that in both the right lung was involved. One was a young adult, the other twice his age; one in April, one in October; one an inflammatory condition, the other a clean case; one an appendectomy, the other a hernia; one under ether, the other novocain; one operation on the right side (appendectomy), the other on the left side (left inguinal herniotomy). Massive collapse occurs as a post-operative complication and following injuries, and may closely simulate pneumonia. Pneumonia is a frequent post-operative complication and for this reason massive collapse may be overlooked. Collapse may follow any operation or injury or the use of any kind of an anesthetic—be it local, spinal, or general.

The condition usually develops during the first few days following operation; the patient complains of sharp pain in the chest, there is increased and embarrassed respiration, cough, and a rise in temperature.

On examination, the apex of the heart will be found to be displaced toward the affected side. All cases of post-operative pulmonary complication should have a roentgenologic examination if possible, and if collapse is present the involved area will show a density equal to the heart shadow or a dense pneumonic consolidation, the diaphragm will be elevated, while the heart and trachea will be displaced toward the side involved.

The treatment is, first, postural, the patient being turned on his side with the involved lung uppermost, and he is induced to cough. This treatment will usually cause the lung to reinflate and the symptoms to subside. If the case is of short duration, the lung clears very rapidly, but in cases that have existed several days there may be some delay, due to an accumulation of mucus, which is Nature's method of producing cough and, finally, recovery. These cases may have an abundant mucous expectoration.

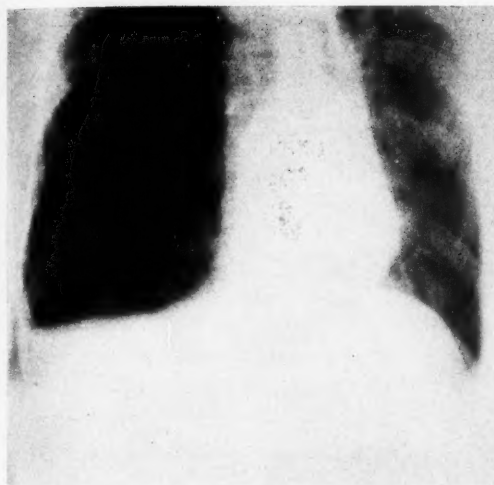


Fig. 6-A. Case 4. Right hydropneumothorax, July 6, 1922.

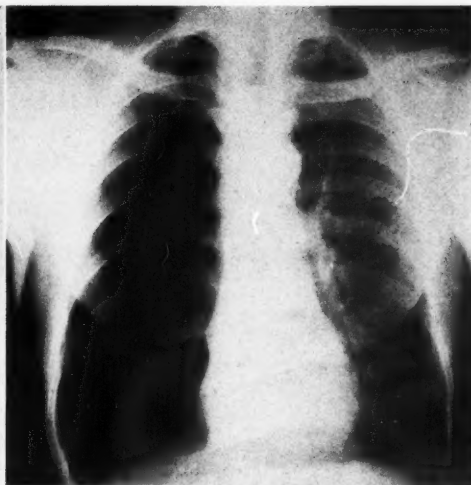


Fig. 6-B. Case 4. Pneumothorax as it appeared during period from 1922 to 1929.

If postural treatment does not reinflate the lung, bronchoscopy is indicated. Sante (4) has suggested that all surgical patients should be turned from side to side every few hours for the first few days following operation as a prophylactic against the occurrence of massive collapse, and he also suggests that drugs having a tendency to concentrate the bronchial secretion and inhibit the cough reflex, such as atropin and morphin, be used as sparingly as possible in the pre-operative treatment of surgical patients.

CASE REPORTS

Case 1. A. S., male, aged 35 years, was admitted October 18, 1928. The following day an operation for left inguinal hernia was done under novocain anesthesia. On the third day post-operative there was a collapse of the right lung, with the symptoms of pain, increased respiration, cough, and a sharp rise in temperature. The patient was turned on his left side and a film, made two hours later, shows the right lung to be fully expanded. The patient was discharged November 4, 1928, fully recovered.

Case 2. H. M., aged 16 years, was admitted April 19, 1929, and the following day an operation was done for gangrenous appendicitis, under ether anesthesia. A bedside film, made on April 22, showed the right lung to be collapsed. The patient was rotated, and on the following day a second bedside film showed the lung to be normally expanded following the postural change. The patient was discharged on May 1, 1929.

Collapse of lung due to tumor of a bronchus cannot be differentiated from idiopathic massive collapse except by bronchoscopic examination. The appearance on a roentgenogram is the same in both conditions, the affected side being dense in appearance, the heart and trachea displaced toward it. The lung which is collapsed but not separated from the chest wall is of the same density as the heart shadow because of the engorgement of the blood and lymph vessels. The diaphragm is elevated and the chest smaller on the side involved.

The following case of carcinoma of a bronchus was of considerable interest because we were able to study the case during

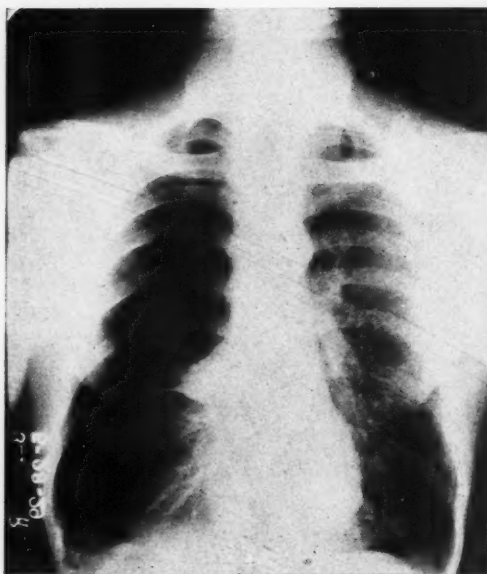


Fig. 7-A. Case 4. May 28, 1929, right lower lobe partially expanded after lung had been deflated for seven years.



Fig. 7-B. Case 4. May 3, 1930, no change in the past year.

several attacks of collapse, followed each time by reinflation.

Case 3. The patient, Mrs. B. R., aged 66 years, was admitted to the hospital on January 25, 1929, complaining of persistent vomiting after meals. This condition had begun in August, 1928, and had continued to the time of her admittance. She gave a history of having had pneumonia in February, 1928, with a fairly good recovery, after which she had been well until August, when vomiting began, and she also experienced complete loss of voice. The vomiting persisted but the condition of her voice improved so that she was able to talk well at the time of admission. Her weight on admission was 86 pounds.

Some time previous to her admission to our hospital a clinical diagnosis of carcinoma of the left bronchus had been made by Dr. Joseph L. Miller, Clinical Professor of Medicine, University of Chicago.

Roentgenologic examination of the chest

on admission revealed complete collapse of the left lung, the trachea and heart being markedly displaced to the left. On account of the persistent vomiting a roentgenologic study of the gastro-intestinal tract with a barium meal was done, but nothing of pathologic significance was found. Following the ingestion of the barium, however, the vomiting, which had persisted for five months, ceased, and the patient showed some improvement in her general condition.

On February 1, 1929, a bronchoscopic examination was done by Dr. L. A. Copps, a member of our group, and the following findings noted: Left abductor of vocal cord paralyzed, lower third of trachea is displaced sharply backward to the left, trachea and bronchi rotated so that a line bisecting main bronchi is at an angle of 60 degrees to the transverse plane and the two main bronchi at first are almost parallel. The left main bronchus is filled with a mulberry-like or cauliflower-like mass, which is not ulcerated

but bleeds easily. A small piece of tissue was removed through the bronchoscope for examination. Dr. C. H. Bunting, of the Department of Pathology, University of Wisconsin, examined this and reported primary carcinoma of bronchus.

A roentgenogram of the chest on March 25 showed the left lung to be fully expanded, the heart and trachea in normal position. On May 21, 1929, a roentgenogram showed the left lung again partially collapsed, and on June 14 another film showed it to be almost entirely collapsed. Another bronchoscopic examination was done on June 19, and a needle containing twelve and one-half milligrams of radium element was implanted in the mass in the left bronchus and allowed to remain for four hours. On June 25, a roentgenogram showed the lung partially reinflated and on June 29 the lung was fully expanded. On July 10, another bronchoscopic examination was made and at that time papillomatous masses were found in both main stem branches. A twelve and one-half milligram needle of radium element was implanted in each and allowed to remain for four hours. Roentgenograms were made on July 13 and 20, and the left lung was found to be completely inflated, the heart and trachea being in their normal positions. The patient was discharged to her home on July 29, where she remained until her death on January 30, 1930.

Pneumothorax occurs with collapse of lung to a greater or less extent, according to the conditions present governing the equalization of air pressure. The amount of pneumothorax present in puncture wounds of the thorax depends on the size of the opening as compared to the size of the bronchus (5). Spontaneous pneumothorax with collapse of lung resulting may be caused by rupture of emphysematous blebs on the surface of the lung (6). These patients usually recover rapidly, with absorp-

tion of the air in a few days. Sante (8) records one case in which the air was completely absorbed and the lung fully inflated in two days, while in another case four weeks were required. In the case of spontaneous pneumothorax that I am reporting at this time, eight years have elapsed and recovery is not yet complete.

Case 4. This patient, Mr. A. B. C., railroad conductor, aged 40 years, was first examined July 6, 1922. He stated that during the previous four years he had been troubled with what he called bronchial asthma, that he felt weak as compared to his former strength, that he was troubled with a cough, and became short of breath on exertion. On examination a large pneumothorax was found on the right side and a roentgenoscopic examination showed a very small amount of fluid in the right pleural cavity. The heart and trachea were not displaced and there was no evidence of any part of the right lung. Frequent roentgenologic examinations were made from 1922 to 1928, and there was never any evidence found of the right lung, never any displacement of heart or trachea, and never any evidence of pleural effusion after the first examination, until an examination of the man in May, 1929, revealed the lower lobe of the right lung to be partially inflated, proving that the right lung had been present, but in a state of collapse. Another examination one year later, in May, 1930, showed the same amount of expansion of the lower lobe as one year previously.

This case demonstrates that a completely collapsed lung may occupy a very small space, provided the pleural surfaces are separated, permitting the retraction of the lung toward the midline.

CONCLUSIONS

1. Because of the fact that the symptoms of post-operative massive collapse and post-operative pneumonia are so similar, an

X-ray examination should be made in all surgical cases having pulmonary complications.

2. A skilled bronchoscopist is not always available, and as most of these cases of post-operative collapse will be relieved by posture this method should be used early.

3. A lung may be completely collapsed, either by plugging of a bronchus or in association with pneumothorax, for long periods of time without apparent impairment of function when reinflated.

4. On account of the long time that a lung may remain collapsed and again begin to function, we must be guarded in our prognosis, especially in cases of pneumothorax, which usually clear up rather quickly but may remain collapsed for years.

REFERENCES

- (1) BRADFORD, SIR J. R.: Oxford Loose-leaf Medicine, 1920, II, 127.
- (2) PASTEUR, W.: (1) International Jour. Med. Sci., September, 1890, p. 242.
(2) Royal College Physicians. Bradshaw Lecture, 1908.
- (3) SCOTT, W. J. M., and JOELSON, J. J.: Post-operative Massive Atelectasis: Influence of Posture. *Archiv. Surg.*, 1927, XV, 855.
- (4) SANTE, L. R.: Massive Idiopathic Collapse. *Annals of Roentgenology*, 1930, XI, 390.
- (5) GRAHAM, E. A.: Maximum Non-fatal Opening of Chest Wall. *Jour. Am. Med. Assn.*, 1919, LXXIII, 1934.
- (6) MILLER, W. S.: (1) A Study of Human Pleura Pulmonalis: Its Relation to the Blebs and Bullæ of Emphysema. *Am. Jour. Roentgenol. and Rad. Ther.*, 1926, XV, 399.
(2) A Further Study of Emphysematous Blebs. *Am. Jour. Roentgenol. and Rad. Ther.*, 1927, XVIII, 42.

DISCUSSION

DR. ROY A. PAYNE (Portland, Oregon): In regard to the use of carbon dioxide gas, not only as a treatment for the condition of massive collapse but also as a preventative measure, this is being used a great deal by surgeons in Portland at the present time.

There is another point in regard to spontaneous pneumothorax which might well be brought out. The slides shown are the last two cases of spontaneous pneumothorax that have come under our attention. The first is

one of a girl who started out with a low-grade pneumonic process in the right lower lobe of the lung. She progressed splendidly, but with a sudden onset of cyanosis experienced difficulty in breathing and there was evidence of the total collapse of the left lobe. There were these adhesions [indicating on slide] showing on the left upper portion which prevented the total collapse. This patient came from a tuberculous family: her older brother had died the year before, apparently having no symptoms and suddenly coming down with miliary tuberculosis and fading out of the picture in a short time. This patient's lung never recovered, and death ensued. We have another case with partial collapse of the left lung that was examined by an associate, and in it again we have diffuse infiltration throughout the lung tissues.

In a moderate number of cases under observation, so frequent has been the association of a low-grade tuberculosis with this spontaneous pneumothorax that I believe every effort should be made to exclude tuberculosis before it is dismissed as not being an etiologic factor. It is not enough to say simply that tuberculosis is not present, because I believe if the cases are studied we will frequently find that those persons who have suffered from spontaneous pneumothorax have a family history of lack of resistance to the germ of tuberculosis, and that this lack of resistance probably renders them more subject to the action of spontaneous pneumothorax.

DR. L. T. LEWALD (New York): I wish to make a plea for a little care in the use of the names given to these conditions. It seems that the word "atelectasis" has now come to represent the type of lesion associated with the plugging of a bronchus such as may follow some operative procedure, while the other type of lesion in which the lung is forcibly collapsed from air entering the pleural cavity is commonly spoken of as "pneumothorax." If one uses the term "collapse" to cover both these conditions, it is confusing, and I hope that we may all make these distinctions. Furthermore, I think the third distinction as to the type of pneumothorax, which

I have regarded as idiopathic or non-tuberculous, marks an entity different from the type shown here, by Dr. Payne, for example, complicating tuberculosis. I have seen it follow interstitial pneumonitis. As for that, there is still a type that is absolutely independent of any pathologic change that has been demonstrated in the lung. It is all very well to say "emphysematous bleb," but there has never been an "emphysematous bleb" demonstrated in a case of this sort. I do not know of any autopsy on a case of this type. These patients usually recover in a few weeks but, as mentioned by Dr. Potter, one cannot be sure that a particular case, even though it is of the simple spontaneous type, will expand. I have published two cases, one that had not expanded at the end of a year and one that had not expanded when it was reported twelve years later, very much like the speaker's cases of pneumothorax on the right side.

DR. K. D. A. ALLEN (Denver, Colo.): I believe it is appropriate to mention three cases that came to my attention a month or two before this meeting. They should, perhaps, be called "traumatic pneumothorax." Two were due to automobile accidents in which ribs were fractured, with one-sided pneumothorax; the third occurred during a *right* kidney operation and involved the *left* side of the chest. All three of these cases had subcutaneous emphysemas in the neck and both sides of the chest. In one of them, the emphysema reached clear to the legs. In the operative case, the pneumothorax extended to the opposite pleural cavity. I am a little curious to learn the route

which that air followed, from the pleural cavity of one side to the opposite side, in one case, and from the pleural cavity of one side to a symmetrical subcutaneous emphysema in the other cases. It has occurred to me that it went to the mediastinum and from there through the deep tissues to the neck. I would like to hear some discussion on that point.

The essayist's plates showed a point in relation to atelectasis which I believe is worth mentioning. One of his cases showed a collapse, by pneumothorax, of the lower right lobe and yet marked translucence was still remaining. A large amount of air remained in that lung. The atelectatic lobe collapsed no more than the pneumothorax-collapsed lobe—it was very dense and not translucent at all. The only difference existing between these two collapsed lobes was that the one still had access to the outside atmosphere while the atelectatic lobe did not. I believe that point in those two situations shows that, regardless of the cause of the collapse, the cause of the density is blockage of a bronchus, preventing access of the portion of the lung served by that bronchus to the outside atmosphere.

DR. POTTER (closing): One point I wish to emphasize is that we should be guarded in our prognosis in cases of so-called idiopathic pneumothorax. Idiopathic pneumothorax may exist for years, as may be seen in the case I have shown. This man's right lung remained completely collapsed for several years and now, after eight years, is only partially inflated and he is still unable to attend his usual duties as a railway conductor.

THE PATHOLOGIC CERVIX: A PRECANCEROUS LESION¹

By B. H. ORNDOFF, M.D., F.A.C.R., CHICAGO, ILLINOIS

FOR the purpose of this paper, I wish to refer to the diseased cervix uteri as the pathologic cervix, and to include all of the conditions affecting its tissues, other than cancer.

A precancerous lesion is a condition of the tissues in which they have suffered insult from irritation, which may affect growth control to such an extent that hyperplasia and malignant tendencies may follow. The term "precancerous" has called forth drastic criticism, but nothing has yet been offered which will better designate the condition which occupies such an important position in pathology and clinical medicine.

Clinicians throughout the world, in discussing the causative factors in cancer, refer to the conditions in tissues which constitute precancerous changes as of very great importance, and their recognition and relief seem equally as important as the cure of a definite cancer. We may quote from Bloodgood, "Cancer never begins as cancer," and from Quigley, "The physician who would serve his patient well in this field must recognize not only early cancer, but he must be able to determine precancerous conditions."

The cells composing any tissue must maintain a definite rate of growth, or reproduction, in order to remain healthy and normal. These cells also perform other functions which characterize their particular tissue. It is when the various functions of the cells are interfered with that the dominant function of growth, or reproduction, stands out pre-eminently, and if the factor of interference is not too great, cell division will continue, other functions being lost, and the tissue thereby will approach the state we

designate as cancer. Obviously the development of this situation in a tissue carries the element of time, since the functional interference must continue through the period of the existence of many succeeding cell groups before the new cells are forced to give up their less fundamental functions and to place in reproduction all of their available power, in the attempt to save the existence of their tissue. It is these tissue changes, with their associated functional phenomena, together with the agent of irritation and the lapse of time that constitute a precancerous lesion.

A study of the etiology and the nature of precancerous lesions always involves a consideration of the diagnosis of early cancer. The site where a cancer begins is always subjected to some kind of irritation, usually chronic in character, before malignancy is established. The cervix uteri is the most frequent site for cancer in woman. Its tissues are probably always subjected to an irritation, attended with disturbance of cell function and cell destruction, before positive cancerous changes can be detected in the cells.

Anatomically, the cervix usually suffers important changes while in the performance of its natural functions: it is indeed the exception, not the rule, to find an undamaged cervix in the parous woman. Damage to the cervix during birth is more frequent and more serious as a rule than the injuries sustained by any of the other structures or organs along the birth canal.

In the cervix, as in many other organs, functional equilibrium is lost whenever there is structural disarrangement. The fact that in the cervical canal, columnar epithelium is laid down on the fibro-muscular composition of the cervix without the support and pro-

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, December 1-5, 1930.

tection of a well-defined basement membrane is one of the factors predisposing this canal to chronic pathologic processes. The cervical canal receives the products of glandular secretion, the structures of which are distributed between the bundles of smooth muscles far beneath the columnar epithelial lining of the canal. It is obvious that very slight structural damage will alter function between the external and the internal os uteri, creating the presence of abnormal endocervical secretions. The presence of normal vaginal bacterial flora, with this, their acid reaction, together with the chemical irritation from disintegrating cellular debris collecting here from corpus uteri during menstruation, are important factors in building within the cervical canal a chronic pathologic lesion.

The vascular and lymphatic arrangements in the anatomy of the cervix are such as will promote quick absorption into the region of the broad ligaments and pelvis, and thereby constitute another important factor for consideration.

Cervicitis is almost always a lesion affecting the vaginal portion of the cervix. The stratified epithelium covering the pars vaginalis is damaged or lost, and the subepithelial structures show vascular injection and other reactions of irritation. This lesion usually indicates an ulcerating lesion in the canal and a pathologic discharge from the cervix into the vagina.

Ectropion and erosions also constitute pathologic lesions within the scope of this paper.

Diagnosis of a pathologic cervix is usually very simple.

Palpation of the cervix and its associated pelvic viscera on a table equipped with an X-ray fluorescent screen, so that visible densities and mobilities may be determined along with palpation, constitutes a very important part in diagnosis. *Inspection* of the cervix, aided by efficient illuminating apparatus, a properly selected speculum which

may be adapted to the vaginal cavity in such a manner that the cervix is properly exposed and illuminated, a graduated flexible probe, uterine dressing forceps, cotton, etc., form another link in the diagnostic chain. Diagnosis of pathology within the cervical canal requires inspection of *trachelograms*. The technic of producing the trachelograms is important, and it is probably most desirable to fill the cervix with the opaque substance over the fluorescent screen, and, when proper angles are observed, expose the films for the trachelograms at that time.

TREATMENT

Treatment of a pathologic cervix is important. Assuming that pathologic cervixes precede the development of almost all malignant cervixes, it becomes necessary that a plan be adopted to secure a positive result, and that the time interval be not too long.

Surgical amputation and surgical repair of the cervix by the older methods have come to be very seldom the methods of choice, since by electrocoagulation and the use of other electrosurgical procedures the end-results are satisfactory and the liability of complication seems almost *nil*. By electrocoagulation all of the diseased tissue can be destroyed, and when a granulation base has been formed, the coagulated tissue becomes separated, leaving a healthy, resistant base upon which a normal mucosa regenerates.

The technic of coagulation is a procedure requiring a working knowledge of the equipment adapted especially for this field, together with sufficient surgical training to enable the operator to enter the operating room with confidence that he will be able to cope with the unusual phases of surgical pathology always encountered in a long series of cases.

SUMMARY

Summarizing the facts which I have endeavored to present, and adding a few more,

the detailed discussion of which my limited time would not permit, I wish to set forth the following statements in a somewhat aphoristic fashion:

1. The importance of a precancerous lesion has been emphasized.

2. Chronic irritation may interfere with cell functions.

3. Irritated tissues may lose all of their functions, except the more fundamental power of reproduction and growth.

4. Attention has been directed to the importance of a pathologic cervix.

5. Subjective symptoms of a pathologic cervix are frequently only a leukorrhea, and the patient must be informed in a manner to inspire confidence, in order that a delay, with disastrous consequences, may be avoided.

6. A pathologic cervix is usually a focus of infection.

7. A pathologic cervix is probably the most frequent example of a precancerous lesion.

8. The anatomy of the cervix uteri is of such a character that very little resistance can be offered to the spread of cancer when cell growth has begun to invade other tissues.

9. Statistics show that cases of cancer of the cervix constitute about one-third of all cases of cancer.

10. Statistics also indicate that more than 70 per cent of parous and 25 per cent of nulliparous women have a pathologic cervix.

11. It is the great frequency of irritation of the cervix that accounts for the very high incidence of cancer.

12. Cancer of the cervix is not known to develop in an otherwise normal cervix.

13. Between fourteen and sixteen thousand women, ranging in age from 30 to 50 years, die annually in the United States from this form of cancer.

14. Elimination of the pathologic cervix

would prevent almost entirely this great loss of life.

15. The value of a periodic pelvic examination for women between 30 and 50 years of age, to be conducted by physicians trained and equipped for this special class of work, can hardly be overestimated.

DISCUSSION

DR. HENRY SCHMITZ (Chicago): The presentation of the subject of the pathologic cervix as a precancerous lesion is a timely one, and Dr. Orndoff deserves our deep appreciation for the scientific investigation made and the method of treatment involved. It is by such investigations that cancer may be headed off, and if similar tactics were applied in other regions of the body the control of cancer would be assured. A pathologic cervix should always be treated, whether it causes or does not cause symptoms. Quite a group of these cases results from a disturbed biology and physiology of the parts seen, especially in the non-deflorated patients. Another group of cases is the result of infection, especially the gonorrheal. This group is the largest in number and the most important. A third group is formed by the traumatized cervix, whereby the cervical canal mucosa is exposed to the irritation of the vaginal secretion and the irritation of the sexual function. In this latter instance, the trauma seems merely an easier access to the same two causes given in Groups 1 and 2.

The question arises as to how we may detect these lesions. Obviously, periodic health examinations are the only means. Such examinations should include a painstaking examination of the cervix and other genital organs. If, on examination, erosions, ulcerations, or nodules are found, then the simple touching with a cotton-covered probe or a superficial incision of the nodule with a scalpel will aid us in differentiating the benign from the malignant lesions. Probably 80 per cent of these lesions are perfectly benign; it is only in the other 20 per cent that we seek the precancerous or cancerous lesion. Free arterial bleeding, continued for some time, is usually a sign of the malignant nature of the lesion. Absence of

active bleeding usually means benignancy. If the former is found, then a biopsy should be done. Immediate frozen section examination will rule out—or in—carcinoma. Benign lesions should be treated by cauterization; there is no other method of treatment so successful. Douching and local medication should be consigned to the scrap heap. They are no longer considered as recognized therapeutic measures for these lesions. The cautery blade or loop must destroy all pathologic tissue to assure complete healing afterwards. Should biopsy show malignancy, then radiation therapy is indicated.

As I stated before, Dr. Orndoff deserves our gratitude for the presentation of this important and timely subject.

DR. GEORGE A. WYETH (New York City): When we realize that one woman in every eight develops cancer and, of these, one out of three develops it in the uterus, and that nine out of ten cancers of the uterus are cervical, we can begin to realize the importance of the work brought out so strikingly by Dr. Orndoff to-day. There are two points in his paper upon which I should like to touch—the etiology and the treatment. However, Dr. Schmitz has gone so deeply into the etiology and covered it so completely that I wish only to emphasize certain points. He says that the site where a cancer begins is always subjected to some kind of irritation, usually chronic in character, before malignancy develops. This, I feel, is now a clinical fact. We have sufficient evidence to bear out this statement. I would call your attention to the conclusions of Dr. Bailey, in his classical work on carcinoma of the cervix and erosion.

More recent research points to the fact that cancer is now to be considered as a process. Thus, Cramer, of the Imperial Cancer Research Laboratories, reports a series of experiments which may prove to be of the highest importance. Cramer has shown that if a large area of the skin of a mouse is subjected to chronic irritation by tar-painting, the development of malignant growth is confined to a very small portion of that area. If papillomas have developed in the area, together with the malignant growth, they retain their benign

character. If, after the removal of the malignant growth, the area of skin in which no malignant development has taken place is preserved, it is found that in that area malignant growth may develop again in a new center, either beginning at the base of a papilloma which may have been left behind or starting as an entirely new growth. Removal of the second malignant tumor has sometimes been followed by the development of a third malignant growth. In further experiments in which irritation was applied directly to the base of a papilloma, immediate malignant development was observed in six adults. Cramer concludes that these observations supply evidence that the development of a carcinoma is not entirely dependent upon changes in the epithelial cells, but that there are local inhibitory factors capable of keeping the malignant development in check, and that the immediate cause of the genesis of a carcinoma may be the removal of a local inhibition residing in tissue elements other than epithelial cells. The process of carcinogenesis is, therefore, not a continuous one, but is composed of two phases: a process of long duration which induces a state of "potential malignancy" kept in check by a local resistance, and, secondly, a local breaking down of this resistance, which allows of an immediate malignant development of the "potentially malignant" cells.

It seems to me that this is analogous to the work Dr. Orndoff has brought out to-day and does apply along just the same lines of reasoning as he has developed here in the etiology of his cervical cancer.

Treatment.—I want to emphasize what Dr. Orndoff has said about coagulation. You know I am really more enthusiastic about coagulation than he is and it pleases me greatly to meet with his experience, and to hear him make such striking, sparkling statements as he has made to-day about electric coagulation being the method of choice in the treatment of these cervical precancerous lesions. It seems to me that if he can do four hundred cases and show that in the cases he has treated malignancy has not developed in one, it is a method of which we must take cognizance.

I would mention that there are two ways of

inducing the same effect in this precancerous condition, namely, by coagulation, as he has advocated; and then I must mention the work of Mortimer Hyams, of New York, who has devised an instrument to apply the cutting current. It is an electrode with a wire bent at right-angles to the straight line of the instrument which he puts up into the cervix, and, turning it, he reams out the interior of the cervix with the cutting current. He seems to think that this is a superior way of doing it. Be that as it may, I was in communication with him just before I left New York and he told me that he has now adopted this procedure in over three hundred cases and has not seen malignancy develop in one of them. If this is so, and we can prevent cancer by cleaning up these cervixes, it seems to me that it behooves us to do it.

DR. H. J. ULLMANN (Santa Barbara, California): There is one point mentioned by Dr. Orndoff and Dr. Schmitz which I wish to emphasize—the biopsy. If one keeps a Gaylor specimen forceps on the tray in the office with the speculum, one can often take a small specimen the size of a split pea from the cervix during the examination of the patient, frequently without the patient knowing that it has been done. Once in a while a tender cervix is found, but this is relatively infrequent. When a biopsy is taken, be sure to get specimens from more than one place. I have received a report of chronic cervicitis from one specimen and carcinoma from another. To again emphasize the necessity for biopsies, I will cite the case of a patient who clinically

showed chronic cervicitis, but the report was definitely malignant. Within the last few months I have examined a patient with a clinical carcinoma of the cervix in gross appearance, yet the report from three separate specimens from three different places on the cervix was chronic cervicitis only. Do not forget that radium is being used very successfully in certain cases in the treatment of endocervicitis.

DR. HENRY SCHMITZ: Dr. Ullmann has asked why I do not recommend the use of radium in chronic cervicitis. I believe that the method which is the safest and curatively best should be the method to use. I feel that the application of radium in chronic cervicitis has an element of danger in it. May I cite a few cases that come to my mind now? I recall a young woman who came to us three or four years ago on account of amenorrhea following the application of radium for chronic cervicitis. In spite of a stenosis of the cervix, she conceived. Although the patient was given the test of labor, a cesarean section had to be done on account of the unyielding fibrotic cervix. I have several other patients under my care who have had chronic cervicitis and have been treated with radium with the result that they menstruate once or twice a year and are sterile. I do not wish to say that the radium was applied incorrectly or in large doses. When one sees a great number of cases of this kind one should pause and hesitate to use radium. On the other hand, the cautery method, described by Orndoff, is safe and heals the cervicitis in the majority of cases.

CHEMICAL EFFECTS OF X-RAYS UPON SOME AROMATIC COLORS AND DYES

By G. L. CLARK, Ph.D., and K. R. FITCH, B.S.¹

Department of Chemistry, University of Illinois, URBANA

THE chief difficulty in measuring X-ray quanta or intensities by chemical methods lies in the fact that the total changes effected by this radiation during a reasonable time interval are too small to readily lend themselves to ordinary analytical procedure. In fact, the minuteness of the changes involved, together with the necessary accuracy needed, precludes ordinary chemical methods from all practical considerations by any but expert analytical chemists. Here exists the chief difficulty in the practical application of Eder's solution (1, 2) or any other similar chemical method to dosage measurements. Yet, the need for some accurate, simple, and convenient method for periodically checking the performance of X-ray tubes and dosimeters still exists.

Many organic compounds change color while exposed to X-rays. The presence or absence of color furnishes some of the most accurate indications known of the progress of many chemical reactions. Of course, many organic reactions occur without color changes, but it frequently becomes impossible to detect non-visible chemical changes of very small magnitude by any simple method. Furthermore, several organic dyes, colors, and structurally related compounds are given internally to patients to increase the visibility of certain body parts on an X-ray film.

Due to the growing importance of this field, articles have appeared from time to time in the literature. H. Bordier (3) studied the action of X-rays on iodine and on starch iodide in aqueous media and found that the results obtained after many hours by ultra-violet light were produced by X-rays

in a few minutes. Glocker (4) investigated the action of X-rays upon iodoform in chloroform and other solvents and observed that the liberation of iodine was some function of the solvent used and probably due to a secondary reaction. Gunther and his co-workers concluded that HCl and HI were first formed when chloroform and iodoform were exposed to the action of X-rays. Ferman (6) first, and later Reinhard and Tucker (7), noticed a slight inversion of sucrose both in the crystalline and dissolved condition upon long exposure to X-rays. Also, many studies concerning the effect of X-rays on complicated substances present in the body have appeared.

Clark, Pickett, and Johnson (8) examined the effect of X-rays upon the anthracene-di anthracene equilibrium, iodine and benzene, the inversion of sugar in the presence of lead nitrate and alpha-acetoxy mercuri-B-methoxy hydrocinnamic ethyl ether. The iodine-benzene sample had less free iodine left after exposure. Free mercury was liberated from the mercury compound.

Of particular interest in this field is the work of Stenstrom and Lohmann (9) in testing a number of colors with X-rays, namely, methylene blue, gentian violet, acid fuchsin, mercurochrome, erythrosin, and eosin. Methylene blue showed the most pronounced color change and the authors suggest its use for dosage measurements.

However, the vast number of organic compounds and their structural complexity make it difficult to correlate experimental data unless they are taken under comparable conditions. Therefore, in this work, quite a few of the general structural types of aromatic colors are tested under the same conditions of exposure to X-rays, to find

¹Fellow of Radiological Research Institute, Inc.

out which kinds are most susceptible to color change. One can suppose that any structural shifts in a complicated molecule will probably start at the bonds which have the greatest lability toward X-rays. By starting with simpler structures with a known reactive group it may be possible to gain some insight into the mechanism of some of the reactions with more complicated compounds.

The color changes were obtained by exposure to X-rays under conditions much less drastic than medical use necessitates. The X-ray apparatus consisted of a Coolidge type tungsten target tube. The samples were placed in two-inch evaporating dishes and exposed for 10 minutes at 50 kilovolts and 1.4 milliampere except in a few special runs. This was deemed sufficient for

standard qualitative test purposes. The X-rays also passed through approximately 15 cm. of air from the outside glass surface of the tube to the upper surface of the solution in the evaporating dish. In every case a non-irradiated control sample was compared with the irradiated solution in glass tubes of the same diameter against a white background. In almost all cases the colors were dissolved at room temperature in freshly boiled distilled water which eliminated any differential effects due to varying amounts of dissolved oxygen.

EXPERIMENTAL RESULTS

The following experiments were made under the standard conditions:

Substance	Color before irradiation	Color after irradiation
1. Phenol + H ₂ O + FeCl ₃	Dull lavender	Slightly paler
2. Phenol + H ₂ O + CoCl ₂	Pale pink	No change
3. Phenol + H ₂ O + CuCl ₂	Pale blue	No change
4. Phenol + FeC ₂ O ₄ + H ₂ O and H ₂ O ₂ to form a little of the ferric color complex	Brownish lavender	Light yellow brown
5. Phenol + H ₂ O + FeCl ₃ and stood 48 hours	Yellowish brown	No change
6. Phenol + H ₂ O + CuCl ₂ and stood 48 hours, filtered and filtrate used	Pale yellowish green	No change
7. Phenol + H ₂ O + I ₂ , stood 24 hours	Yellow	No change
8. Phenol + H ₂ O + Na ₂ Cr ₂ O ₇ + NaOH	Light green	No change
9. Phenol + H ₂ O + FeCl ₃ + (NH ₄) ₂ C ₂ O ₄	Brown	Paler brown
10. Alpha naphthol + H ₂ O + NaOH (dilute)	Brown	Darker brown
11. Alpha naphthol + H ₂ O + NH ₄ OH	No darkening with H ₂ O ₂ Pale greenish brown Not darkened by H ₂ O ₂ : 24 hours later—a murky solution	Darker brown: 24 hours later—a murky solution
12. Alpha naphthol + H ₂ O + C ₂ H ₅ OH + NH ₄ OH	Green	Murky liquid, tar-like fluid residue at bottom: 24 hours later, no change
13. Alpha naphthol-ferric chloride complex + ether and dissolved in oil	Rose purple	No appreciable change
14. Brominated derivative of alpha naphthol ferric chloride complex + ether and dissolved in oil	Deep purple	No change
15. Beta naphthol + H ₂ O + FeCl ₃ + HCl	Bright yellow green	No change
16. Beta naphthol + H ₂ O + CH ₃ OH + FeCl ₃	Blue green A precipitate gathered in both blank and exposed samples	No change
17. Martius yellow (free acid) + H ₂ O	Pale greenish yellow	No change
18. Martius yellow + H ₂ O + NaOH	Bright yellow	No change
19. Martius yellow + H ₂ O + NH ₄ OH	Yellow	No change
20. Martius yellow + H ₂ O + NH ₄ OH + CoCl ₂	Red brown Brownish precipitate formed	Brownish precipitate formed

Substance	Color before irradiation	Color after irradiation
21. Resorcin + H ₂ O + FeCl ₃	Purple—fades after a few days	Lavender
22. Resorcin + H ₂ O + CuCl ₂	Pale greenish brown	More of a yellowish brown with a precipitate formed
23. Resorcin + H ₂ O + NaOH	Brownish yellow	Orange brown
24. Resorcin + H ₂ O + NH ₄ OH	Light yellowish green	Deeper green
25. Resorcin + H ₂ O + NaOH + urea and heated to boiling	Olive green Stable over night. Not stable over 3 days Not darkened by H ₂ O ₂	Dark olive green
26. Resorcin + H ₂ O + NaOH + pyridine and heated to boiling	Dark olive green Stable for over a week in a corked bottle	Darker olive green
27. Resorcin + H ₂ O + NH ₄ OH + CuCl ₂	Purple	Reddish purple
28. Resorcin + H ₂ O + I ₂ + KI + NaOH	Yellowish olive green Unstable for long periods	Dark olive green
29. Resorcin + H ₂ O + FeCl ₃ + H ₂ O ₂	Yellow brown	No change
30. Resorcin + H ₂ O + bleaching powder	Light reddish brown	Slight darkening
31. Resorcin + H ₂ O + Ca(OH) ₂	Colorless	No change
32. Resorcin + H ₂ O + Hg Cl ₂	Colorless	No change
33. Pyrogallol + H ₂ O + FeCl ₃	Red—soon turned gray	Gray—no change
34. Pyrogallol + H ₂ O + FeCl ₃ (excess) + H ₂ O ₂	Gray brown	No appreciable change
35. Pyrogallol + H ₂ O + FeCl ₃ + (NH ₄) ₂ C ₂ O ₄	Brownish violet	No change
36. Pyrogallol + H ₂ O + CoCl ₂ + NH ₄ OH + HCl (excess)	Orange brown	No change
37. Gambine—R + H ₂ O + HCl	Olive yellow	No change
38. Gambine—R + H ₂ O + NaOH	Olive yellow	Slight change
39. Gambine—R + H ₂ O + CuCl ₂ + NH ₄ OH (excess)	Olive green	Very slight change
40. Gambine—R + H ₂ O + HCl + CuCl ₂	Brown	Very slightly darker
41. Gambine—R + H ₂ O + HCl + AlCl ₃	Light yellow green	No change
42. Hg salt of Gambine—R + H ₂ O	Light yellow green	No change
43. Fast green + H ₂ O + HCl	Light brownish yellow	No change
44. Fast green + H ₂ O	Light yellowish green	No change
45. Fast green + H ₂ O + NaOH	Apple green	No change
46. Fast green + AlCl ₃ + H ₂ O + NaOH (excess)	Pale green	No change
47. Fast green + H ₂ O + AlCl ₃	Pale bluish green	No change
48. Fast green + H ₂ O + FeCl ₃	Olive green Four hours later—a brownish precipitate formed	Slight change After four hours no precipitate
49. Fast green + H ₂ O + CoCl ₂ + HCl (concentrated)	Pale blue green	Less bluish—more greenish
50. Fast green + H ₂ O + HgCl ₂ + HCl	Pale yellowish brown	No change
51. Fast green + H ₂ O + CuCl ₂ + HCl	Pale olive green	No change
52. Aniline	Reddish brown	Slightly lighter
53. Aniline HCl + aniline + CH ₃ OH + HOH	Yellowish brown	Slightly lighter
54. Aniline + I ₂ + K ₂ Cr ₂ O ₇	Dark blue	A precipitate noticed
55. Aniline HCl + furfural + CH ₃ OH + HOH	Red	No change
56. Nitraniline + CH ₃ OH + HOH + furfural + (NH ₄) ₂ C ₂ O ₄	Red	No change
57. Nitro benzene + CH ₃ OH + H ₂ O + HCl + furfural + (NH ₄) ₂ C ₂ O ₄	Yellow	No change
58. Fuchsin + H ₂ O	Violet red	Paler violet red
59. Fuchsin + H ₂ O + (NH ₄) ₂ C ₂ O ₄	Reddish violet	No change
60. Alizarin + H ₂ O + NaOH	Pale purple	Paler purple
61. Alizarin + H ₂ O + NH ₄ OH	Reddish purple	Redder—less bluish
62. Alizarin yellow (Na salt) + H ₂ O	Pale olive yellow H ₂ O ₂ makes it colorless	Slightly paler
63. Alizarin yellow (Na salt) + H ₂ O + NaOH (concentrated solution)	Olive yellow	No change
64. Alizarin yellow + H ₂ O + NH ₄ OH (concentrated solution)	Olive yellow	No change
65. Alizarin yellow (Na salt) + H ₂ O + FeCl ₃	Olive brown	Slight change
66. Alizarin yellow + H ₂ O + CuCl ₂	Pale brown	No appreciable change

Substance	Color before irradiation	Color after irradiation
67. Alizarin yellow + H_2O + $CoCl_2$	Reddish brown	No change
68. Alizarin yellow + H_2O + NH_4OH + $(NH_4)_2 C_2O_4$	Pale olive yellow	No change
69. Mercury salt of alizarin yellow + H_2O + HCl	Orange brown	No change
70. Benzo purpurin + NH_4OH + H_2O	Red orange	No change
71. Benzo purpurin + HCl + CH_3OH + H_2O	Blue	No change
72. Benzo purpurin + H_2O + HCl (very dilute acid)	Dark lavender	No change
73. Benzo purpurin + H_2O + $HgCl_2$ (saturated)	Dull red	Very slightly lighter
74. Phenolphthalein + H_2O + NH_4OH	Red violet	Slightly lighter; a few flakes of a precipitate formed
75. Phenolphthalein + H_2O + NH_4OH (very dilute solution)	Pale lavender	No change
76. Phenolphthalein + H_2O + $NaOH$; very dilute and small concentration of (OH)	Light violet	Slightly paler
77. Phenolphthalein + H_2O + $(NH_4)_2 C_2O_4$ + $NaOH$	Pale violet	Light dull red
78. Fluorescein (free acid) + H_2O	Yellow with greenish fluorescence	Very slightly paler
79. Fluorescein + H_2O + $NaOH$	Yellow—much greenish fluorescence	Slight change
80. Fluorescein + H_2O + HCl	Yellow	No change
81. Fluorescein + H_2O + HCl + $CuCl_2$	Greenish yellow	No change
82. Fluorescein + H_2O + NH_4OH + $CuCl_2$	Olive green	No change
83. Tetra acetoxy mercury fluorescein + H_2O + $NaOH$	Reddish brown precipitate slowly formed	Olive brown
84. Fluorescein + H_2O + $FeCl_3$	Olive yellow precipitate formed	No change
85. Fluorescein + H_2O + $CoCl_2$	Brownish red	No precipitate
86. Fluorescein + H_2O + $(NH_4)_2 C_2O_4$	Yellow	No change
87. Eosin (free acid) + H_2O (saturated solution)	Pink	No appreciable change
88. Eosin + H_2O + $NaOH$	Pink	Very slightly duller
89. Eosin + H_2O + HCl	Light pink	No change
90. Eosin + H_2O + $FeCl_3$	Dull pink	Very slightly duller
91. Eosin (free acid) + H_2O + $CoCl_2$	Lavender pink	No appreciable change
92. Acetoxy mercury eosin	Red	No change
93. Eosin + H_2O + HCl + $(NH_4)_2 C_2O_4$	Pale pink	Lighter red
94. Erythrosin (free acid) + H_2O (saturated solution)	Rose pink	Red precipitate formed
95. Erythrosin + H_2O + $NaOH$	Brownish pink	No change
96. Erythrosin (free acid) + H_2O + $FeCl_3$	Orange pink	No change
97. Acetoxy mercury erythrosin + H_2O	Reddish pink	Slightly lighter
98. Mercurochrome-220 + H_2O (concentrated solution)	Reddish brown	Paler color due to formation of heavy red precipitate
99. Mercurochrome-220 + H_2O (very dilute solution)	Light lavender against a white background	No change
100. Tri-acetoxy mercury phenolphthalein + H_2O + $NaOH$ (dilute solution nearly neutral)	Red violet	Very slightly paler
101. Tri-acetoxy mercury phenolphthalein + H_2O + $NaOH$ (concentrated $NaOH$ solution)	Dull violet	Slight change
102. Tri-acetoxy mercury phenolphthalein + H_2O + NH_4OH	Dull violet	Slight change
103. Tri-acetoxy mercury phenolphthalein + H_2O + NH_4OH (concentrated)	Lavender	More reddish
104. Tri-acetoxy mercury phenolphthalein + H_2O + $NaOH$ + $(NH_4)_2 C_2O_4$	Dull lavender	One hour later—colorless, with greenish fluorescence
105. Tri-acetoxy mercury phenolphthalein + H_2O + $ZnCl_2$ (very dilute)	Very pale lavender	Reddish lavender—too concentrated to show much fluorescence

Substance	Color before irradiation	Color after irradiation
106. Methylene blue + H ₂ O	Azure blue	Paler blue
107. Methylene blue + H ₂ O + HCl	Pale blue	Paler blue
108. Methylene blue + H ₂ O + NaOH	Pale purple	Paler violet
109. Methylene blue + H ₂ O + FeCl ₃	Bright yellowish green	Yellowish green; next day —more yellowish
110. Indigo + H ₂ O	Light ultramarine	Pale grayish blue
111. Indigo + H ₂ O + HCl	Light ultramarine	Pale grayish blue
112. Indigo + H ₂ O + NaOH (very dilute solution)	Light yellow	Colorless
113. Indigo + H ₂ O + NaOH (more concentrated solution)	Olive yellow	Pale greenish yellow
114. Indigo + H ₂ O + HCl + HgCl ₂	Pale blue	Paler blue

All the experimental work took place at 50 kilovolts and 1.4 milliamperes. In the following experiments the time of exposure was changed from the standard of 10 minutes.

Substance	Time (Min.)	Color before irradiation	Color after irradiation
115. Aniline + H ₂ O + I ₂ + HCl + HNO ₃ + KClO ₃	15	Green	No change
116. Aniline + HNO ₃ + HCl + NaNO ₂ + H ₂ O	15	Reddish brown	No change
117. Fluorescein (free acid) + H ₂ O (saturated solution)	15	Yellow	Very slight change
118. Fuchsin + H ₂ O	20	Red	Lighter red; H ₂ O ₂ did not darken
119. Mercurochrome 220 + H ₂ O (saturated solution)	20	Orange red	No appreciable change
120. Fluorescein + H ₂ O	20	Yellow	Very slight change
121. Methyl orange + H ₂ O + NaOH	30	Orange	No change
122. Methyl orange + H ₂ O + HCl	30	Red	No change
123. Methylene blue + H ₂ O	20	Blue	Very light blue
124. Methylene blue + H ₂ O + acetone (few drops)	20	Blue—same as above	Light blue; acetone tends to prevent color change
125. Fluorescein (free acid) + H ₂ O (saturated solution)	30	Yellow	Very slight change
126. Fluorescein + H ₂ O + HCl (saturated solution)	30	Yellow—no fluorescence	Slight change Heavy precipitate
127. Fluorescein + H ₂ O + NaOH	30	Brownish yellow	No change

Phenol plus ferric chloride in aqueous solution formed a complex color (1) quite unstable at room temperature and eventually becoming a brown-colored solution which by itself gives no further visible color changes when exposed to X-rays under the mild test conditions (5). In general, the ferric chloride phenol complex is unstable in the presence of soluble oxalates such as oxalic acid and sodium oxalate. This color, then, is more sensitive to the presence of these compounds than Eder's solution (1, 2). In the ferrous oxalate experiment (4), the magnitude of the color change was great because of the small concentration of the fer-

ric phenol complex and the presence of excess but slightly soluble ferrous oxalate. In the ammonium oxalate experiment (9), a slight color tinge remained which returned upon the addition of hydrogen peroxide after the irradiation. These results tend to show that X-rays may give an unstable aggregation a transition toward stability.

The purple ferric chloride color with alpha naphthol is insoluble in water and hence the results (12, 13) are incomparable. However, in any study of the structures involved, alpha naphthol becomes exceedingly important as a starting point because the molecule, like phenol, presumably contains

but one reactive group. The sodium and ammonium salts in a basic solution when exposed to the X-rays had a color change which was not duplicated by the addition of hydrogen peroxide. In the ammoniacal sample (11), a murky greenish white colored solution formed upon standing for twenty-four hours in both unexposed and exposed samples. In (12) the addition of ethyl alcohol simply caused more alpha naphthol to dissolve with the consequent formation during exposure of a dark semi-fluid decomposition product in sufficient quantity to settle toward the bottom. This is presumably the cause of the darkening occurring in the less concentrated solutions. Martius yellow, a nitro derivative of alpha naphthol, neither changed color nor formed a precipitate in dilute solutions under the test exposure to X-rays. Since this derivative has a greater coloring power than alpha naphthol the substituent nitro groups evidently altered the lability of the previously reactive bonds toward mild radiation impulses at the energy level of X-rays.

Resorcin contains two reactive groups and should display a reactivity similar to phenol plus the further effect of the second active group. These resorcin complex colors furnished some good color changes, although, in general, they are unstable over long time intervals.

Gambine—R or alpha—naphthaquinone oxime, has a simple structure for a color and seemed in general quite stable toward the standard irradiation as shown by color change. Fast green in general also showed stability.

Aniline and similar compounds compose the basis of a large number of dyes and colors. Also the fact that aniline seems most easily oxidized to colored complexes and compounds in solutions containing some of the mineral acids indicates that the lability of certain bonds was shifted towards sensitivity to oxidizing reactions. The colors produced vary from red through blue to black,

depending upon conditions and the type of oxidizing agents used. Aniline hydrochloride plus furfural (55) in an aqueous solution forms a brilliant red color which was unchanged by the X-rays. Thus if irradiation could start some reducing reaction selective toward nitro benzene, exposure to X-rays would cause a color formation. Ammonium oxalate was evidently not suitable for this purpose. Fuchsin, a red oxidation product of aniline oil previously tested by Stenstrom (9), faded (58) under the influence of X-rays. Potassium chlorate or hydrogen peroxide (118) when added to the faded sample failed to restore the color, showing that X-rays did not simply reduce the fuchsin to the leuco base. Ammonium oxalate (59), instead of causing this reduction to take place, simply absorbed some of the energy of the radiation without, in turn, affecting the fuchsin. In some tests with fuchsin in dilute solution, the color change at first was not great, but after standing awhile the irradiated sample became practically colorless. This perhaps indicates that some of these color changes are caused by secondary reactions started by the primary X-ray reaction.

Alizarin contains two reactive hydroxyl groups in the ortho position and hence might form colored condensation products. Thus one could expect at first a color change (61) rather than a color fade. Twenty-four hours later the color of the exposed sample had approached the shade of the unexposed blank. Alizarin yellow showed no appreciable color changes. Benzo purpurin, also related to alizarin in structure, changed color less than the latter. However, because of the different coloring powers of these dyes, one must compare them at equal molecular concentrations to draw conclusions as to the effect of the different groups on the lability of the compounds toward color change by X-rays. Such work was considered far beyond the scope of this qualitative survey.

The phthaleins constitute a well investigated type of dye structure which is known to exist in several tautomeric modifications. Only slight color changes were obtained with phenolphthalein (74-77) and these were visible only in very dilute solutions. Here again ammonium oxalate seemed to have an inhibiting effect on the reaction. Fluorescein in general furnished no appreciable color changes except for a metallic lake. Eosin and erythrosin were stable under the test conditions. The mercury derivatives (92, 97) probably simply precipitated from supersaturated solutions.

Many of the color changes in the X-ray exposures were obtained with metallic lakes. In some cases, as with phenol and resorcin colors, the metals formed unstable intermediate colors of different hue along the path toward equilibrium. This type of metallic color upon exposure to X-rays should give color changes of large magnitude provided the length of time necessary to reach equilibrium is neither too long nor too short. In other cases the metals were probably present only in solution along with the color. Where pH changes alter the stability of the color, the most important effect is probably that of a buffer. When this action is not important any different color changes in this type of solution are probably caused by the difference between absorptive effects on the primary radiation and any effects of secondary radiation emitted at other energy levels. Also a highly colored metallic ion may obscure other color changes taking place. Most solutions tested which were obviously of this type gave color changes less in magnitude than the color itself. Another kind of metallic lake is a stable metallic salt of definite composition. Mercurochrome is the generic name for various mercury substituted dyes of the phthaleins (10). Mercurochrome-220 appeared at least as stable as, if not more so than, either fluorescein or eosin. However, phenolphthalein which is

red has a tri-acetoxy mercury derivative which possesses a deep purple color while the di-mercury derivative more closely resembles the parent substance in color. The tri-acetoxy mercury phenolphthalein samples (100-105) became more reddish upon exposure to X-rays. Some of the exposed samples faded out a few hours after treatment, suggesting the possibility of a secondary reaction. Although the color is too unstable for practical use in dosage measurements, the results do show that in general when the color difference between the parent dye and the metallic salt is large in magnitude the prospects for a visible change upon exposure to X-rays are far better.

Stenstrom and Lohmann (9) carried out an extensive series of tests upon methylene blue and showed that a small amount of acetone decreased the sensitivity of the dye toward X-rays, thus demonstrating the importance of the environment in these reactions. Methylene blue (106-109) (123-124) also changed color extensively in caustic as well as in neutral and acid solutions, evidently but slightly affected by pH change so far as the lability of the susceptible bonds in the molecule are concerned. Indigo (110-114) also changed color over a wide pH range although it appeared more sensitive in the yellow basic solution. Several experiments were made with methyl orange (121-122) without success. Also fuchsin and indigo have about the same color change both in aerated and freshly boiled distilled water.

Many of the experimentally visible color changes were predicted from known facts and principles concerning the fundamental structure of the complicated dye molecules, and almost any color change desired is obtainable with the proper structures and substituent groups. Most changes obtained here belong to the color-fade class, which is a disadvantage in the use of the pure dye alone. However, one can easily use mixtures of two or more colors each affected dif-

ferently by X-rays to obtain any color change desired. No generalizations based on experimental data secured with pure dyes are at present applicable to the reactions of their colored metallic salts. However, the authors believe that in searching for susceptible compounds of this type one may save time by trying first the colored salts of those heavy metals which exist in two or more valence forms.

The previous work of Clark and Pickett and Stenstrom and Lohmann on methylene blue demonstrates the all-important influence of environment upon the progress of visible color changes in aromatic compounds when exposed to X-rays. Freshly boiled distilled water was simply chosen as perhaps one of the most easily obtainable constant environments which also offered opportunities for changing pH, for using inorganic metallic salts, for obtaining uniform concentrations of the colors, etc. However, there is no proof that aqueous solutions furnish the best surroundings for even a majority of the possible color changes, and perhaps various materials such as cloth, etc., impregnated with changeable colors, offer just as fertile a field for future use. Probably there exist color-producing reactions which take place only while under the influence of X-rays, but the authors preferred to work with simple colors for the sake of simplicity. Also, all experiments were carried out at room temperature, which was considered constant enough for the survey. While some experiments with fuchsin and indigo seemed to give about the same degree of color change in both the aerated and freshly boiled distilled water, some of the others were noticeably different. Experimental work in oxidizing, neutral, and reducing environments may furnish important clues as to the reaction mechanisms in many cases. No such work was attempted here.

Once the environment is disposed of it is obvious that the magnitude of the color change during irradiation depends upon the

lability of the bonds, the concentration of the dye, and the dosage. The dye must have sufficient coloring power for a minute change affecting a comparatively small number of molecules to become visible. Thus the same color change can be used to cover a wide range of X-ray intensities by simply employing the proper amount of color in each case.

In a field as large and as complicated as this one, the authors hesitate to put forward any particular dye or color as undoubtedly possessing better characteristics than all the rest. As a matter of fact, the best colors probably have not been found as yet. Any color, however, to have a wide range of practical applications as an intensity or quantity indicator will have to possess a high degree of stability toward slow reactions, once the standard solutions are made up. However, as a result of the comparative tests, a few fairly stable types of structures dissolved in aqueous solutions seem susceptible to X-rays. They are fuchsin, alizarin in ammoniacal solution, indigo, methylene blue, and perhaps the green resorcin-pyridine color in caustic solution, not mentioning, of course, the vast field of metallic lakes.

Thus X-rays in particular and perhaps radiation in general furnish mankind with one of the most delicate and sensitive tools by which various bonds and linkages in complicated structures can be attacked, and their relative stabilities compared.

SUMMARY

1. A large number of aromatic colors and dyes were exposed to X-rays under the same condition of irradiation, to determine, if possible, some of the general types of structures giving good visible color changes. Some of those showing the most promise from the point of view of stability and degree of color change are the triphenyl methane, alizarin, thiazine, and indigo types.

2. Experiments were started upon simple molecules with but one or two reactive groups and were carried through to more complicated structures.

3. Substituent non-metallic groups may change the susceptibility of the labile bond in a simple aromatic structure toward X-ray exposure.

4. Metallic salts and complexes of an aromatic color may give color changes upon exposure to X-rays much different from that of the parent dye, thus vastly increasing the number of possibilities of these changes.

5. Any type of color changes desired, such as color increases, decreases, etc., can be obtained by proper selection of the colors.

6. From the known chemical and physical properties of these compounds, many X-ray color changes can be predicted in advance.

7. The magnitude of the field is such that in all probability the color most suitable

as an intensity indicator has not yet been found.

8. The X-ray in particular and radiation in general furnish one of the most sensitive tools known for the examination of complicated reactions.

LITERATURE

- (1) WYCKOFF, R. W. G., and BAKER, LILLIAN E.: *Am. Jour. Roentgenol. and Rad. Ther.*, December, 1929, XXII, 551.
- (2) QUIMBY, EDITH H., and DOWNES, HELEN R.: *RADIOLOGY*, May, 1930, XIV, 468.
- (3) BORDIER, H.: *Compt. rend.*, 1916, CLXIII, 291.
- (4) BAUMEISTER, L., and GLOCKER, R.: *Ztschr. f. phys. Chem.*, 1921, XCVII, 368.
- (5) GUNTHER, PAUL, VON DER HORST, H. D., and CRONHEIM, GURG: *Ztschr. f. Elektrochem.*, September, 1928, XXXIV, 616.
- (6) FERNAU, A.: *Kolloid Ztschr.*, August, 1923, XXXIII, 89.
- (7) REINHARD, M. C., and TUCKER, K. L.: *RADIOLOGY*, February, 1929, XII, 151.
- (8) CLARK, G. L., PICKETT, L. W., and JOHNSON, E. D.: *RADIOLOGY*, August, 1930, XV, 245.
- (9) STENSTROM, W., and LOHMANN, A.: *RADIOLOGY*, March, 1931, XVI, 322.
- (10) WHITE, E. C.: *Jour. Am. Chem. Soc.*, 1920, XLII, 2355.

ACCURATE MEASUREMENT OF SMALL ELECTRIC CHARGES BY A NULL METHOD¹

By LAURISTON S. TAYLOR, WASHINGTON, D. C.

Abstract.—In the use of an electrostatic system for measuring charges and currents, it is necessary to know the electrostatic capacity of the system. For small capacities the error in this measurement may easily be 1 per cent. There is here described a new method for calibrating a null system in such a manner that the capacity of the leads does not enter and which, therefore, permits a reduction in the

calibration error to one-tenth. When a system is once calibrated in the manner described, any unknown capacity whatever may be added to the leads without affecting the measurement of the desired quantities. Expressions are given for the sensitivity of the system in terms of readily measured quantities. Applications to the measurements of current, charge, and capacity are discussed.

I. INTRODUCTION

WHEN making accurate measurements of small charges or currents by electrostatic means one of the greatest difficulties encountered is that of correctly determining the capacity of the system. This is due largely to the inability, without taking elaborate precautions, to determine corrections for the capacity of the leads from the capacity bridge to the electrometer system. These errors have been discussed in detail by Rosa and Dorsey,² who showed that for capacities of the order of 500 cm. they might be as much as 1.0 per cent. This difficulty has been encountered in endeavoring to make accurate measurements of the ionization produced in air by X-rays, in connection with the International Unit of X-ray quantity—the roentgen.

Investigators have used several different means of measuring the small currents involved. The factors favoring the use of an electrostatic measuring system have been discussed and it has been shown^{3, 4} that the null electrostatic method, in that it does not

introduce field distortion in the ionization chamber, has an advantage over deflection methods. An additional difficulty in deflection electrostatic systems of small capacity arises from the motion of the leaf or fiber altering the capacity and thereby the calibration.

In null electrostatic measuring systems the potential of the electrometer and collecting system is maintained at some constant value—usually zero with respect to ground—by one of three methods. One method of accomplishing this is by communicating to the collector system an evaluated charge or current opposite in sign to that measured. Failla⁵ and Jaeger⁶ have devised sources of current for this purpose which serve as working standards. For absolute measurements this method is impractical because the working standard requires a calibration in kind. In the second method, the charge accumulated on the collector system is compensated by increasing its capacity to maintain the potential constant. Aside from the mechanical difficulties involved in a circuit of this kind, it has the disadvantage of necessitating an elaborate calibration. In a third method, sometimes known as the

¹See first footnote, *RADIOLOGY*, January, 1931, XVI, 9.

²E. B. Rosa and N. E. Dorsey, *Bureau of Standards Bull.*, III, 433.

³G. Failla, *Am. Jour. Roentgenol. and Rad. Ther.*, January, 1929, XXI, 47.

⁴L. S. Taylor, *Bureau of Standards Jour. Research* (R. P. 56), 1929, II, 771; *RADIOLOGY*, April, 1930, XIV, 372.

⁵G. Failla, *RADIOLOGY*, October, 1930, XV, 437.

⁶R. Jaeger, *Strahlentherapie*, 1929, XXXIII, 542.

Townsend method,⁷ the communicated charge is entirely localized in a condenser of constant known capacity, but varied potential difference as determined by a voltmeter. In this, the greatest source of uncertainty is

ionization chamber, and electrometer, together with a calibrated variable capacity which will be described below). One plate of C is connected to earth, while the corresponding plate of C_1 is connected to a

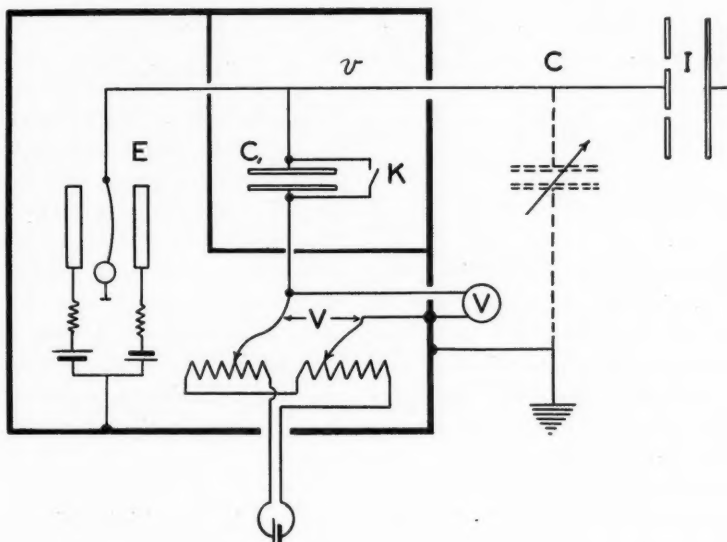


Fig. 1. Null electrostatic system for measuring small charges or currents. The part within the heavy lines is referred to as the "isolated system" and is so constructed that all capacities remain fixed.

the voltmeter, while in the second method it is the variable condenser. Since, in general, a variable condenser suitable for such purposes is a less dependable instrument than a voltmeter, the third method is from this standpoint distinctly preferable to the second.

II. THEORY OF METHOD

1. Measurement of Charge

Given a circuit as represented in Figure 1, an unknown charge is communicated to the system containing an accurately known capacity C_1 and the unknown remainder C (which represents the capacity of the leads,

potentiometer circuit so as to bring it to any desired potential above or below that of the earth. As indicated by the deflection of the electrostatic E , this communicated charge raises the insulated side to a calibrated potential v relative to the earth as zero. Calibration of the electrostatic is readily carried out by closing the key K and shifting the potentiometer contact to give any desired potential v which is read directly on the voltmeter. (The electrostatic can at the same time be adjusted so that the deflection is at the most sensitive part of the scale.) With the electrostatic at v , K is opened and an unknown charge Q communicated to the system through, say, the ionization chamber

⁷J. S. Townsend, *Phil. Mag.*, 1930, VI, 598.

I. This requires the potentiometer contact to be shifted to V in order to bring back to, or maintain, the potential of the system, at the calibrated value v , as indicated by the electroscope.

Since v is unchanged by this operation the charge on the part of the system of capacity C remains unchanged, hence the entire charge Q is accumulated on C_1 . Its magnitude is readily obtained from the measured values; that is

$$Q = C_1 (v - V) \quad (1)$$

2. Calibration of Condenser

The difficult part of this method lies in the accurate calibration of C_1 . To present an adequate method of calibration is the prime object of the present communication.

C is here made up, in part, by an accurately calibrated variable condenser connected into the system as dotted in the figure. The total capacity *in situ* of this condenser is not accurately known because the leads, etc., introduce an uncertainty. However, its capacity differences are very accurately known.

Starting now with the system uncharged (that is, when V is zero, K is first closed, then opened again), the potentiometer contact is shifted to a value V such that the electroscope indicates accurately any convenient potential v . Since no charge has been communicated to the system by this operation, the induced charge ($-Q$) on the unknown capacity C_1 must be exactly equal and opposite to that (Q) on the unknown remainder of capacity C .

Since

$$-Q = C_1 (v - V)$$

and

$$Q = Cv$$

it follows that

$$C_1 (V - v) = Cv \quad (2)$$

The experiment is now repeated with C changed by an accurately known increment

to a new value C' and V , consequently to a new value V' .

In this case

$$C_1 (V' - v) = C'v \quad (3)$$

Subtracting Equation (3) from Equation (2), C_1 , the desired quantity, is obtained in terms of the accurately known magnitude $(C - C')$, namely,

$$C_1 = (C - C') \frac{v}{V - V'} \quad (4)$$

from which expression all extraneous capacity, such as the ionization chamber, electroscope, and leads are wholly eliminated. Since the capacity of the system varies with the deflection of the electrometer, the same deflection must be used throughout any one calibration. After having determined C_1 , other capacities of unknown value may be inserted in the collector system without in any way affecting its calibration. This is of great practical importance, as shown later.

3. Sensitivity of System

Although, as seen in Equation (1), the quantity of the charge measured does not depend on the magnitude of the distributed capacity C , yet the sensitivity of the measuring system must obviously decrease as C increases.

The sensitivity $\frac{\Delta s}{\Delta Q}$ of this type of null circuit can be expressed in terms of the sensitivity of the integral parts: that is,

$$\frac{\Delta s}{\Delta Q} = \frac{\Delta s}{\Delta v} \cdot \frac{\Delta v}{\Delta Q} \quad (5)$$

where Δs is the increment in scale divisions of the electrometer deflection for a given increment ΔQ of the imparted charge; and at the same time Δv is the increment in volts corresponding to the deflection increment Δs .

The electrometer sensitivity, $\frac{\Delta s}{\Delta v}$, is a magnitude which is obtainable separately, is

The sensitivity of the compensating system is then

$$\frac{\Delta v}{\Delta Q} = \frac{1}{C_1 k} \quad (9)$$

in which k is a *sensitivity factor* of the system as given. Since C_1 is constant and known from (4) we have now expressed the sensitivity $\frac{\Delta v}{\Delta Q}$ without C being explicitly involved. The working sensitivity of Equation (5) then becomes

$$\frac{\Delta s}{\Delta Q} = \frac{\Delta s}{\Delta v} \cdot \frac{1}{C_1 k} \quad (10)$$

which, since k increases with the stray capacity C , shows that the sensitivity decreases as the stray capacity increases.

By considering all capacities outside the heavy lines of Figure 1 to be removed from the system, we may determine a value of the sensitivity factor k_0 which is characteristic of the isolated part. Thus

$$k_0 = \frac{V_0}{v_0} \quad (11)$$

serves in practice as a ready control of the system.

4. Method of Operation

Referring to Equation (4), only two capacities whose difference is accurately known are required for the calibration of C_1 . If, however, a variable capacity C having a number of accurately known capacity differences be used for the calibration, the following graphical analysis which gives equal weight to all observations shows readily how to obtain the magnitude of any of the capacities in the system, including C_1 .

Remembering that $\frac{V}{v} = k$, we have from Equation (7)

$$C = C_1 k - C_1 \quad (12)$$

showing a linear relationship between C and k . Here it is seen that C_1 may be obtained either from the slope or from the C intercept; also that $k=1$ when $C=0$; and

finally that for $k=k_0$, C takes on a derived value which will later be found serviceable in the analysis.

In plotting C against k , as in Figure 2, the capacity differences for various settings of C being accurately known while the absolute capacity is yet undetermined, we are unable to assign C its correct coördinate position at the start but merely a place, say a . Then, for a C scale, may be chosen coördinates representing *capacity differences* employed without regard to the location $C=0$.

The next point b , corresponding to a known capacity change from a , is then plotted with reference to a , etc. A straight line drawn through the plotted points must also pass through the point $k=1$, $C=0$ and thus locate the origin. Having determined the position $C=0$ it is now possible to read off the graph the value of the other capacities in the circuit. For example, the isolated system has a determined sensitivity factor k_0 , so that referring to (12) the corresponding ordinate C_0 gives what will be called the stray capacity of the isolated system. Similarly, the difference between the ordinate C_0 and that C_p at any other point P on the curve gives the corresponding capacity of the external system.

Obviously such a system is applicable to the accurate measurement of any inserted capacity; for example, $(C_p - C_0)$. We will consider C as made up of the stray capacity C_0 of the isolated system and the total external capacity C_{ext} . Then Equation (12) becomes

$$C_1 k = C_1 + C_0 + C_{ext} \quad (13)$$

In this, C_1 is determined by Equation (4), C_{ext} is removed, and C_0 is determined from the relation

$$C_1 k_0 = C_1 + C_0 \quad (14)$$

Combining these

$$C_{ext} = C_1 (k - k_0) \quad (15)$$

For any given measuring system, C_1 and C_0 and k_0 remain fixed so that the measurement of any capacity, such as C_{ext} , requires

but a determination of k with the external capacity inserted.

III. EXPERIMENTAL STUDY

1. Description of System as Used

We will now examine a specific null circuit represented in general by the diagram in Figure 1 and for the isolated part in Figure 3. In this latter, E is a string electrometer of the general Edelmann type in which the deflection of a very fine platinum (Wollaston) wire, under an adjustable tension between the charged knife-edges, is observed by a suitable microscope. The potential on these knife-edges is supplied, through very high protective resistances R , by two 22.5 volt batteries. For any given potential on the knife-edges, the voltage

sensitivity $\frac{\Delta s}{\Delta v}$ of the electrometer is adjusted by varying the tension on the fiber by the micrometer head, H . The sensitivity of this particular instrument can be readily changed from 100 divisions per volt to 0.01 division per volt.

The resistances of the compensating potentiometer are operated by the knobs "coarse" and "fine" on the front of the aluminum box container. Potentiometer, charging batteries, compensating condenser C_1 and the necessary leads are all contained in this box, the electrometer circuit being led out through an amber bushing L . All parts are carefully shielded electrostatically. G is a grounding key and K a switch to short circuit C_1 (for the purpose of calibrating the electrometer). Leads to the potentiometer battery and the voltmeter are in the form of jack and plug at M and N , respectively.

2. Calibration

The capacity used for the calibration of C_1 was a precision variable condenser of

TABLE I.—VARIABLE CONDENSER ALONE

Nominal capacity C	k	Average deviation from mean	Deviation from mean
1	2	3	4
0.0*	1.057	0.0015	Per cent 0.14
43.8	1.120	.0016	.14
97.6	1.185	.0018	.15
175.9	1.279	.0008	.06
254.5	1.378	.0021	.15
313.5	1.470	.0014	.09
412.0	1.569	.0018	.12
490.6	1.666	.0009	.05
		Average.....	.11
VARIABLE CONDENSER + RUBBER CABLE			
215.2**	1.968	0.008	0.36
313.5	2.075	.005	.24
412.0	2.232	.006	.32
		Average.....	.31
VARIABLE CONDENSER, HIGH VOLTAGE			
117.1	1.207	0.005	0.41
195.6	1.303	.003	.23
274.1	1.397	.002	.14
352.8	1.495	.005	.33
431.7	1.590	.004	.25
		Average.....	.27

*Variable condenser actually removed and L covered.

**Capacity of variable condenser only. Full value of C is this plus the unknown capacity of the cable.

well known make; the voltmeter was of the laboratory standard type; the capacity differences and voltmeter were calibrated with an accuracy of 0.1 per cent by the electrical division of this Bureau.

The accuracy of the results obtainable under working conditions is best brought out graphically. The factor k (Equation (9)) may be obtained from the slope of the curve V plotted against v —a series of which curves are given in Figure 4 for several different settings of the variable condenser C .

The first part of Table I gives results of a number of determinations of k for different nominal values of the external capacity C , in which the variable condenser was connected to the terminal L by a well insulated and shielded conductor of unknown capacity. The average deviation of five determinations of each k is seen to be within the 0.1 per cent accuracy of the measuring instruments.

Plotting (circles, Fig. 5, Curve I) these

values of k as abscissæ and the corresponding variable condenser values as ordinates, it is found that all of the points lie closely on a straight line. According to (12) the slope $\Delta C/\Delta k$, which is obtainable in terms

condenser system alone was found to be $1.057 \pm 0.0005 \mu\mu f$.

This curve might be given its coördinate position on a $C-k$ plot by extending it to the point $k = 1$; hence, also, the ordinate

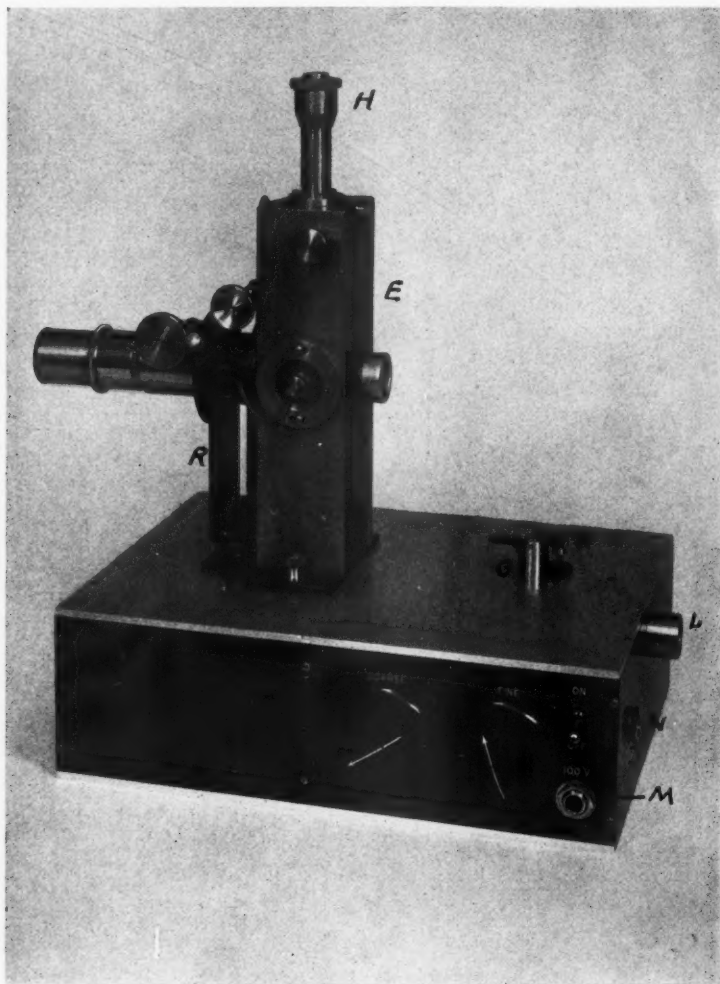


Fig. 3. Photograph of "isolated system" as used in the study.

of the accurate differences in capacity, gives C_1 as $809.2 \pm 0.4 \mu\mu f$.

Having removed the condenser C and covered the amber bushing L with a cap, the sensitivity factor k_0 for the electrometer-

value $C = 0$, located as seen at -48 on the variable condenser scale. The value of the internal lead capacity C_0 may be read from the curve at the point $k = 1.057$, thus giving $C_0 = 46 \mu\mu f$. Likewise the value of C_p ,

at the point P , for example, is found to be k_0 in Equation (15), giving $C_p = 459.8 \mu\mu f$. $460 \mu\mu f$.

These capacity values may be calculated more accurately from Equations (14) and (15). Using Equation (14) for $k_0 = 1.057$ we find $C_1 + C_0 = 855.3 \mu\mu f$ where, since

3. Factors Affecting Sensitivity

The second part of Table I gives values of k for three nominal values of the variable condenser, to which was connected a

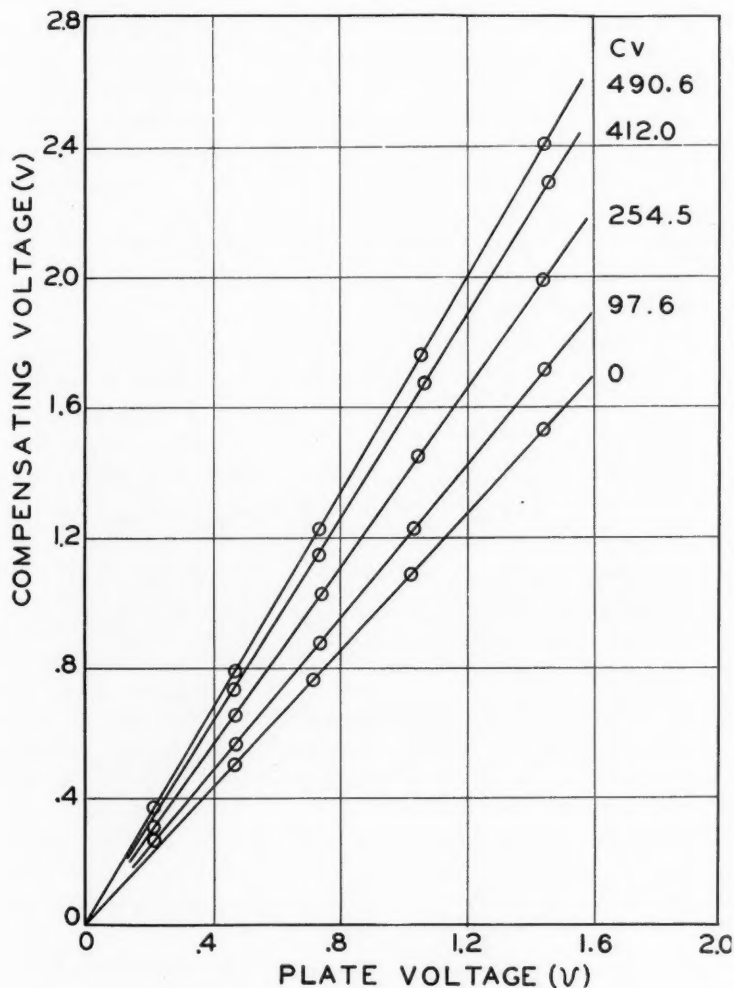


Fig. 4. Curves showing the evaluation of the sensitivity factor k over a range of potentials.

$C_1 = 809.2 \mu\mu f$, we have $C_0 = 46.1 \mu\mu f$. The capacity at C_p , for which $k = 1.569$, is obtained by substituting the values of k and

shielded, rubber, single-wire cable of unknown capacity, with the shield grounded to serve as a condenser having a poor dielec-

tric. The fourth column of this part compared with the part above shows that the precision of measurement was not so good—the average deviation changing to 0.31 from 0.11 per cent which, as already stated,

ing C_1 is obvious⁹—a conclusion supported also by the fact that, when the cable was replaced by a highly insulated condenser of about the same capacity, the points fell well along a straight line, the slope of which rep-

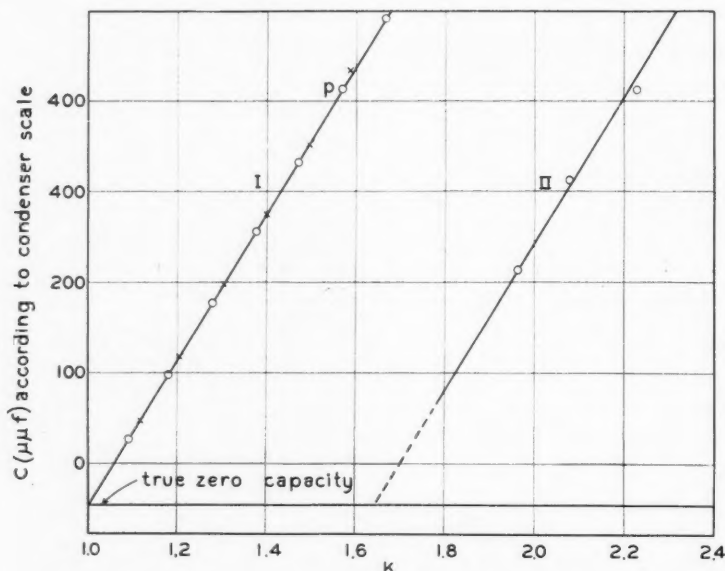


Fig. 5. Curves showing the evaluation of the fixed capacity C_1 by means of an accurate variable external capacity. Curve I (circles) using low voltage, (crosses) using high voltage; Curve II using a rubber cable in the external system.

was the error of calibration. The greater error (0.31 per cent), however, is due to the experimental difficulty in determining k ; for, due to dielectric absorption in the rubber cable, it was difficult to fix with accuracy upon the V necessary to apply to C_1 to induce a definite potential v_0 on the electrometer.⁸

Reference to the corresponding Curve II in Figure 5 shows the same effect in that the plotted points determined with the cable in the system do not fall closely on the straight line drawn parallel to Curve I. The superiority of conditions when all questionable external capacity is removed while calibrat-

resented satisfactorily the capacity as checked by other means. Furthermore, the average deviation from the mean for the values of k made with the well insulated unknown was 0.12 per cent as against 0.31 per cent for the cable. This small average deviation, being again of the order of the error of the instrument calibration, indicates that the larger deviation (0.31 per cent) for the rubber cable was due to absorption, not to the magnitude of C .

In the measurements for the first and second parts of Table I, the electrometer sensitivities were, respectively, about 13 and

⁸This absorption is not operative when using, as in current measuring, the system at $v = 0$.

⁹It is of interest to note that using Equation (15), the capacity of the cable was found to be 522 μf as compared with 526 μf obtained with a capacity bridge calibrated with an accuracy of 1 per cent.

17 divisions per volt; v was never greater than 1.5 volts, and, consequently, the external condenser offered no difficulties due to leakage. However, with v increased to 80 volts and the sensitivity decreased to about 0.3 division per volt, leakage became appreciable and k was subject to error as indicated in the third part of Table I where the average deviation was 0.27 per cent as against 0.11 per cent in the first part. The values obtained are plotted as crosses on Curve I (Fig. 5). Such conditions should, of course, be avoided when determining C_1 .

IV. APPLICATION TO CURRENT MEASUREMENTS

In the measurement of current by this method, a time measurement, of course, enters. In the particular case of measuring X-ray intensities, a shutter in the X-ray beam between tube and ionization chamber is so controlled that it remains open for a definite interval of time during which the charge is wholly compensated, holding $v = 0$, by varying the potential on C .^{10, 11}

In practice it is extremely advantageous to use a shielded rubber cable for connecting the electrometer to the source of current. As shown above, the presence of unknown lead capacities does not affect the measured value of the charge, although it does affect the accuracy of the measurement.

The effect of poor insulation may be eliminated by choosing such conditions that $v = 0$ with respect to the shielding. This confines leakage to the condenser C_1 , and it is a relatively simply matter to construct this fixed capacity so that leakage between its plates will be negligible. In the isolated part of the system here described, a 20-volt charge on the condenser leaked to ground at the rate of only 3 per cent in 8 hours;

but, with a rubber cable attached, the same leakage occurred in about 10 minutes.

To obtain the desired sensitivity with any length of cable added to the system, the electrometer sensitivity may be changed in accord with k as brought out in Equation (9).

To test the effect of a poor dielectric in the external condenser, two sets of intensity measurements were made of the same X-ray beam, using a standard X-ray ionization chamber.¹² In the first set, the electrometer and ionization chamber were connected by an amber insulated conductor having a capacity of about 206 μf and negligible leakage. In the second set, the connection was by the shielded rubber cable having a capacity of about 525 μf . For this the electrometer sensitivity was adjusted to accord with the change in k , approximately double that of the first case. The respective average deviations from the mean of 10 observations for each of the two cases were found to be 0.33 and 0.32 per cent, respectively, the averages of the two runs differing by 0.13 per cent. These deviations from the mean were no more than should be expected from the X-ray intensity variations.

In a null circuit previously described by the author¹³ the expression for the magnitude of the ionization current involved the total capacity C_T of the system instead of simply C_1 as above. The fact that the total capacity C_T can not be measured accurately (with a bridge, as previously done) renders the other method less satisfactory than the present one. Intensity measurements of the same X-ray beam by the two outfits showed a difference of nearly 1 per cent, which is principally attributed to the error in the measurement of C_T . Compared with the average deviation above, of one-third this magnitude for both the highly insulated and the cable connected systems, the superiority of the method here presented is evident.

¹⁰D. L. Webster and A. E. Henning, *Phys. Rev.*, 1923, **XXI**, 301.

¹¹See Footnote 4.

¹²L. S. Taylor and G. Singer, *Bureau of Standards Jour. Research* (R. P. 211), 1930, **V**, 507; *RADIOLOGY*, December, 1930, **XV**, 637.

¹³See Footnote 4.

THE ROENTGEN DIAGNOSIS OF AORTIC ANEURYSM

By HARPER G. SICHLER, M.D., University Hospital, ANN ARBOR, MICHIGAN

THE definite antemortem diagnosis of aortic aneurysm depends entirely upon the direct demonstration of the lesion by roentgenologic methods. The fact that comparative statistics of autopsy and clinical material indicate that many cases escape diagnosis would suggest strongly the advisability of more use of thorough roentgen studies of the cardiovascular syndromes.

Since a knowledge of the pathologic anatomy of aneurysm is essential to successful diagnosis, this part of the subject must be briefly reviewed. An aneurysm is defined by Osler (1) as a tumor containing blood in direct connection with the cavity of the heart, the surface of a valve, or the lumen of an artery. This is expressly said to be not entirely accurate, especially as it does not include the dilatation aneurysms of the aorta.

Aortic aneurysm is by far the most common and important clinical variety, and is not a very uncommon disease. It was found in 2.4 per cent of 16,200 autopsies (2). Of these, the diagnosis had been made clinically in only 43 per cent. Boyd (3) has estimated, on the basis of 4,000 reported cases, that aortic aneurysm is the cause of death in about 0.5 per cent of the deaths in American cities. Lemann (4) reported 47 cases in 25,513 patients (0.3 per cent), and found 67 aortic aneurysms in 2,000 autopsies (3.3 per cent). He believed that the diagnosis was being missed in many cases, as did also Boyd. Additional evidence of this was given recently by Levine (5), who reported 17 cases of aortic aneurysm found at autopsy, of which only 12 had been diagnosed clinically.

ETIOLOGY

Aortic aneurysm results primarily from

a local or diffuse weakening of the walls of the aorta. This is practically always the result of an aortitis, especially of the more chronic types. It is well known that syphilis is the chief cause of all chronic aortitis, and consequently it is usually estimated that from 80 to 90 per cent of all aortic aneurysms are due to syphilis. Among the rarer causes of aortitis (acute and subacute) mentioned by Albutt (6) are: the exanthems, diphtheria, typhoid fever, rheumatic fever, influenza, streptococcus infections, and extensions from a vegetative endocarditis. It is thought that these will only rarely lead to the formation of an aneurysm. The only other agent leading to weakening of the aorta is embolism of the small vessels of the aortic adventitia and vasa vasorum. These are usually infected emboli from a vegetative endocarditis, and hence the aneurysms which may result are known as mycotic aneurysms.

There is general agreement that the common arteriosclerotic changes of the aorta play little or no part in the production of aneurysms. Hypertension and physical overwork are regarded as purely secondary factors, because they can never cause an aneurysm as long as the aorta retains its normal strength and resiliency.

Syphilitic aortitis does not usually occur until several years after the primary infection, but in some cases it may appear within one or two years (7, 8). Lamb (9) states that syphilitic aortitis occurs in 25 per cent of all syphilitics, and that aortic aneurysm occurs in about 30 per cent of all cases of syphilitic aortitis. Since it is generally estimated that from 10 to 20 per cent of the total population is infected with syphilis, it is only surprising that more cases are not found.

CLASSIFICATION AND PATHOLOGY

True aneurysms are those in which one or more coats of artery form the walls of the aneurysm. They are divided into three chief groups:

1. Dilatation aneurysms, which consist of a more or less uniform enlargement of the lumen of the aorta, are usually limited to a certain portion of the aorta, resulting in a fusiform or cylindrical aneurysm, but a generalized or diffuse dilatation of the first part of the aorta may occur.

2. Circumscribed saccular aneurysms, which are the most common type, consist of a localized distention or bulging of one side of the aorta, after adequate damage of the intima or media, or both together.

3. Dissecting aneurysms consist of a splitting off of one or more coats, usually the intima, from the remainder of the aortic wall, forming a false tube through which the blood flows. This is a rare type of aneurysm in a pure state, the majority combining a saccular component.

The first group, or dilatation aneurysms, were first described by Hodgson in 1815, and were fully investigated by Thoma (10), who described the pathology (mesaortitis) and named the four chief forms as (1) single fusiform aneurysms, (2) multiple spindle-shaped aneurysms, (3) the saccular added to the spindle form, (4) the tent-shaped or sphenoid. Osler (11) headed a section of his work: "Dilatation Aneurysms of the Aorta (Dilatation of the Aorta—Chronic Aortitis)," thus indicating that he considered chronic aortitis with dilatation to be an aneurysm.

The only difference between the saccular aneurysm and simple dilatation, or arteriectasis, is that given by Kaufmann (12), who, quoting Pommer, states that aneurysm is characterized by a solution of continuity of the elastic tissue of the media, while in arteriectasis (simple dilatation) only a thinning of the media occurs. This means

that in aneurysm there must be a rupture of one or more coats of the aorta—usually of the intima and media together. The dilatation aneurysms have usually no rupture of the aortic coats, and for this reason are not considered by some pathologists to be true aneurysms. For clinical purposes, however, they are always included in the group of aneurysms.

It is obvious that there is no definite way of telling from the roentgen silhouette (or other clinical means) whether or not there is a rupture of one or more coats of the aorta, but probability favors the assumption that in a dilatation of any marked size a rupture of some kind has occurred. The discrepancies between vital and autopsy percentages show that many cases are missed, and many of these must come from the smaller aneurysms because of the comparative ease of diagnosis of most of the large aneurysms.

Saccular aneurysms, even of small size, soon become nearly filled with a deposit of laminated fibrin clot, and hence do not usually pulsate. Dilatation aneurysms, because of their form, do not contain clots until a large size is reached, so their pulsation is usually marked.

Aneurysms are most common in the ascending, transverse, and descending aortic arch. According to Lucke and Rea (13), the most common sites are (1) the ascending arch, (2) the junction of the ascending and transverse arch, (3) the transverse arch, (4) the junction of the transverse and descending arch. Small aneurysms near the sinuses of Valsalva just above the aortic valves are common (14), and frequently rupture into the pericardium. Abdominal aneurysms occur about one-tenth as often as thoracic aortic aneurysms, while aneurysms of the descending thoracic aorta are the most uncommon of all. Dilatation aneurysms are usually regarded as limited to the ascending and arch portions of the aorta,

but Neuhoﬀ (15) has reported five cases of dilatation aneurysm occurring in the descending thoracic aorta. These and abdominal aneurysms usually erode the spine, the erosion being characterized by the preservation of the intervertebral discs, so that a scalloped appearance results.

ROENTGEN APPEARANCES

The roentgen appearances of thoracic aortic aneurysms were discussed by Williams in the second edition of his book, issued in 1902, and from this basis the typical findings were organized and clearly stated by Baetjer (16) in 1906. He described the findings, depending on location, as: (1) Aneurysm of the ascending arch casts a shadow more to the right of the sternum, and anterior; (2) aneurysm of the transverse arch casts a shadow slightly to the left of the midline which extends well up into the neck; (3) aneurysm of the descending arch casts a shadow to the left and posterior; (4) the rare aneurysm of the descending aorta near the diaphragm may displace the heart upwards and appear as a pulsating mass to the left of the median line.

These observations are still standard and form the basis for localizing any aortic aneurysm. Köhler (17) has noted that an aneurysm of the descending thoracic aorta may appear as a projection on the right border of the cardiac shadow just above the diaphragm.

A thorough fluoroscopic examination, utilizing both the right and left oblique positions, is indispensable for an examination of the whole length of the aorta and to determine the relation to it of any suspicious areas. To accomplish this satisfactorily it is essential to be familiar with the appearance of both the normal aorta, especially the senile "uncoiling" (18), and the pathologic aorta, particularly the widening and uncoiling which occur so commonly in syphilitic aortitis (19, 20).

The value of observing the presence or absence of pulsation, and its type, in a suspicious mediastinal mass is not very great, because aneurysms may or may not have a systolic, expansile pulsation, depending on the amount of fixation to the surrounding tissues and the extent to which they are filled by a laminated clot (21). Large sacular aneurysms rarely pulsate for this reason, while fusiform (dilatation) aneurysms of the ascending aorta usually have a marked pulsation, because it is only when the aortitis involves the root of the aorta, producing an aortic insufficiency, that a wide expansile pulsation occurs (22). Expansile pulsations, such as are seen in the normal aorta, are sometimes noted in small aneurysms, but they are usually very difficult to distinguish from the pulsations which may occur in mediastinal tumors, either from their vascularity or from transmitted pulsation.

The syphilitic aorta has a characteristic appearance which was first noted and described by Dr. P. M. Hickey. This is the "squaring" of the aortic arch in which the transverse portion turns at a sharp angle from both the ascending and descending portions of the arch, as seen in the direct lateral view. In well marked cases the three sides of a square are thus outlined by the inner border of the aorta, in contrast to the symmetrical curve normally observed. The outer border of the aorta preserves its usual rounded appearance, and the caliber of the aorta is moderately increased throughout the entire arch. The junction of the ascending and transverse portions is the point which first shows the sharp angulation, and it is here that the angulation is always greatest and most distinct. In early cases the right-angled turn is limited to this point, while the junction of the transverse and descending parts is still rounded.

This appearance has been noted in all stages of development, and the extent of the squaring seems to correspond to the degree

of syphilitic involvement. It is limited to syphilitic aortitis, and is not seen in hypertensive or arteriosclerotic aortic disease. It will, therefore, be found in all cases of syphilitic aneurysm, except in those in which the aneurysm grossly deforms the arch. The mechanism of the production of this squared appearance is not definitely understood, but it is probably due to the combined effect of the thrust of the blood column against the weakened walls of the aorta, which appear to weaken at the points of junction to such an extent that sharp turns are produced in place of the normal curve.

The major X-ray evidence of abdominal aortic aneurysms (and sometimes of those of the descending thoracic aorta) will usually be the typical scalloped erosions of the spine seen in the lateral projection, although it is stated (23) that in some cases abdominal aneurysms may produce a large globular shadow which extends up into the chest. In doubtful cases visualization of the esophagus with a barium mixture is a valuable method of outlining the descending aorta, as the esophagus will be pushed forward and displaced to either side by an aneurysm of this region (24).

DIAGNOSIS AND DIFFERENTIAL DIAGNOSIS

The signs and symptoms resulting from the pressure of a large aneurysm are well known and need not be repeated. In the case of early aneurysms, especially those of the ascending aorta and arch, the chief symptoms are dull substernal pain (sometimes referred to the shoulder), and dyspnea, usually paroxysmal in character. As these are also the symptoms of aortitis, only the roentgen examination can decide whether an aneurysm is present in addition to the aortitis. Hoarseness from laryngeal palsy is common.

The special liability of the trachea and main bronchi (especially the left) to be compressed by pressure from even small aneu-

rysms of the transverse and descending aortic arch often produces atelectatic or emphysematous changes in the lungs which can usually be recognized only on the X-ray film. Bronchiectasis may occur distal to the compression and produce X-ray evidence in addition to the usual abundant sputum. Bronchial irritation also produces a chronic and often paroxysmal cough, which, together with the hemoptysis which may occur from repeated small hemorrhages into the respiratory tract, often results in a diagnosis of pulmonary tuberculosis, which was one of the most common false diagnoses found by Boyd (3). Several cases of atelectasis of one or more lobes of the lung from the pressure of an aneurysm have been reported (25, 26), and a case in which this occurred will be described later. In the absence of other evident explanation, atelectasis should always raise the question of aneurysm, especially if the patient is syphilitic. Aortic involvement usually occurs later than cerebrospinal syphilitic involvement (27), so there are often neurological signs of syphilis, such as unequal or Argyll-Robertson pupils, to aid the diagnosis of syphilitic infection.

In the presence of suggestive signs or symptoms, the diagnosis must be made or discarded entirely on the results of the roentgen examination. If findings indicative of aneurysm are found, the differential diagnosis must be made from several conditions which may simulate it closely on the X-ray film. These are chiefly aortitis, mediastinal tumors, lung tumors, and, more rarely, interlobar effusions, cysts of the lung, spinal abscesses, and pericardial diverticula.

The differentiation between aortitis and aortic aneurysm has not received much attention from recent writers on the subject. Most of them seem to require a definite sacculatation before making the diagnosis of aneurysm. Thus Kurtz and Eyster (28)

state: "In cases where the aortitis has progressed to such an extent that aneurysm formation has occurred, a localized area of sacculatation can be visualized under the fluoroscope and the diagnosis definitely confirmed." Such a requirement would not recognize a fusiform or diffuse aneurysm until a very large size had been reached. Steel (29), in describing the findings of syphilitic aortitis, mentions "irregular and also general dilatation," and later says, "Localized dilatations are common and are probably due to the disruption of the elastic fibers so common in luetic aortitis," but does not mention that an early fusiform aneurysm has exactly the same appearance. Samuel (23) appreciates the difficulty and says, "Observers differ, and what appears to be a dilatation to one is an aneurysm to another," and adds, "early recognition (of an aneurysm) is important for prognosis because if it is seen early, the outlook is better."

This is the chief reason why an attempt should be made to distinguish more clearly between aortitis and aneurysm, or at least to recognize the latter as early as possible, for it is obvious that in many cases it will be impossible to say when aneurysm formation has actually begun. The fact that the prognosis of aneurysm is much better when discovered early (and the patient put on a proper regimen) has been emphasized by several writers.

Baetjer in his original paper declared that aortitis could be distinguished from aneurysm by the fact that in aortitis the abnormal widening receded between pulsations, while in aneurysm the widening remained unaltered between pulsations. This observation was repeated by Carman (30) in 1912, but since then I have been unable to find any reference to this method in the literature. The reasons for it being discarded are not very clear, but it was probably found not to hold true in all instances.

If it were a valid distinction it would certainly be most valuable, as there is at present no way of distinguishing between simple dilatation and small fusiform aneurysms. It would seem to be preferable to err on the side of radicalism, for to treat a case of aortitis for aneurysm would do no harm (and probably do good as a prophylactic measure), while to treat a patient with aneurysm only for aortitis might shorten his life more than necessary.

Mediastinal tumors are sometimes differentiated from aneurysm only with great difficulty. In the usual case the characteristics of a mediastinal tumor are sufficiently marked to separate them clearly from aneurysm, but in exceptional cases this will not hold true. The shadow of a mediastinal tumor is usually dense and homogeneous, and the borders are usually clear-cut and distinctly lobulated. It is only rarely that an infiltrating border is observed, but an irregularity due to "lobulation" is the common finding. In contrast, the border of an aneurysm is smooth and curved.

The density of the aorta is usually greater than that of mediastinal tumor, and hence the aorta can frequently be distinguished from the shadow cast by a mediastinal tumor. Tumors of the mediastinum, when of large enough size to be confused with aneurysm, usually extend out from the hila on both sides unequally, but the inequality rarely takes the form of what Kienböck (31) considers to be a characteristic "aortic asymmetry," which is due to the inequality of the projection of the aneurysmal sac to the right and left sides. He adds that if the upper and lower points on both sides are connected by slightly curved lines an "aortic oval" always is formed which points obliquely upward to the left with its long axis running from right and below to left and above. The "Thoma-Kienböck rule," which states that an aneurysm hardly ever occurs in an otherwise normal aorta, is also valu-

able. Thus if the aorta is dilated in the remainder of its length, the mediastinal shadow is probably an aneurysm, while if it seems free from disease aneurysm is not indicated.

Clinical evidence of syphilis, or a positive Kahn or Wassermann reaction, is strong evidence in favor of aneurysm in equivocal cases. Tumors generally grow more rapidly than aneurysms, but the best test in doubtful cases is to give one or two full value test irradiations, which will cause a rapid retrogression in size in practically every mediastinal tumor, while the size of an aneurysm will not be affected. These test radiations should be employed in every doubtful case, because of the unequivocal manner in which they make clear the diagnosis.

Primary lung tumors of bronchial origin do not often cause confusion with aneurysm. The infiltrating border which they usually possess is sufficient in most cases to prevent any confusion. Nevertheless, in the exceptional case when the tumor has a smooth border and the aorta is dilated, mistakes can occur (Case 4). The atelectasis which these growths are so prone to produce (together with aneurysms) may lead to their being erroneously diagnosed when none is present (Case 3). Aneurysm should always be considered when unexplained atelectasis is present.

The tumor masses of the mediastinum and of the hilar regions are the only conditions which will ordinarily be confused with aneurysm, but at times some lesions of the lung parenchyma, the spine, or the heart itself may cause difficulty. Vaquez and Bordet (32) state that right interlobar effusions may sometimes simulate a large aneurysm. The lower position of the inferior contour of the shadow cast by an effusion, and the usual sharp localization in the oblique and lateral views, are said to be the chief points of differentiation from aneurysms. The same authors state also that

hydatid and dermoid cysts of the upper and medial portions of the lung may be mistaken for aneurysms, although their clearly circular form is usually sufficient for identification.

In exceptional cases the shadow of a thoracic Pott's disease may resemble that of an aneurysm. The Pott's abscess has usually a mottled character from the presence of bony debris, and detailed examination of the spine will always show the spinal disease and make the diagnosis clear. Cardiac aneurysms are very rare, and careful fluoroscopic examination should be sufficient to establish their nature. Another interesting though rare cardiac condition which should be differentiated from aneurysm has recently been reported (33). This is the pericardial diverticulum, and it is said to have the following roentgen findings: (a) *positive*—diffuse cardiac enlargement, together with an abnormal shadow at its right border; (b) *negative*—normal lungs and aorta, and persistence of the positive finding on repeated examinations.

The chief difficulty in differential diagnosis, however, and the one which should be emphasized, is that of distinguishing between aortitis and early aneurysm, especially of the fusiform type. The characteristic appearance of an aneurysm, *i.e.*, a localized sac formation which may or may not pulsate, is seen only in advanced cases, except in those which form sacculations in the initial stage of the pathological process. These could not ordinarily cause confusion with the concentric dilatation of aortitis. Early fusiform aneurysms result in the formation of local and general dilatations which are entirely similar to those occurring in advanced grades of aortitis. This is as would be expected, because the pathologic process is the same in both cases.

Aneurysms of this type will increase slowly in size, forming a progressively larger dilatation, until an organized blood clot has

formed and the process finally becomes more or less stabilized. This point of stabilization is not reached until at least a fairly large size has been attained and there would no longer be a possibility of confusion with pure aortitis. The changes which might occur in an uncomplicated aortitis are slight in comparison, consisting at the most of a slight increase in the general caliber of the aorta, more especially at its root, incident to the relaxation of the aortic ring which commonly occurs as a part of the syphilitic process.

This difference in the progress of fusiform aneurysm and aortitis should be utilized by keeping under observation all cases of syphilitic aortitis which show evidence of dilatation until it has been determined whether or not the aortitis is complicated by aneurysm formation. This procedure would also detect aneurysms arising from a previously uncomplicated aortitis at a time when the prognosis is best, because the response to conservative treatment is relatively much better when the diagnosis is made early (23).

REVIEW OF CASE MATERIAL

At the University Hospital during the last five years there have been 77 cases in which a final diagnosis of aortic aneurysm was made. The total number of admissions during this period was 121,325, so that the percentage of occurrence rate was only 0.06 per cent, which is much lower than any reported during recent years. This low percentage is probably due chiefly to three factors: first, that the number of negroes, among whom aortic aneurysm occurs with comparative frequency, seen here is small, due chiefly to the northern location; second, that a large proportion of patients come from farming districts, where syphilitic infection is usually considered to be less common, and third, that large numbers of children and young adults, who rarely develop

aneurysm, are included in the total admission figures.

All but two of the 77 cases had clinical evidence of syphilis, so that those of syphilitic origin constituted 97 per cent of the total. This is a very high figure, higher than any previously reported, and illustrates very well the predominance of syphilis as the cause of aortic aneurysm. Both of those in whom no evidence of syphilis could be discovered were females. The proportion of syphilitics who also had an aortic aneurysm was found, however, to be much lower than would be expected from the percentages given by Lamb (9), (25 per cent of syphilitics develop aortitis, and 30 per cent of these develop aneurysm), which seem to be lower than those generally accepted. It was determined by actual count that, excluding repeat examinations, the number of positive Kahn reactions during the year 1930 was 3.8 per cent of the total number of admissions during that year, so that for the five-year period it is estimated that there were 4,510 cases of syphilis, of which only 75, or 1.6 per cent, had an aortic aneurysm. The large number of children and young adults with congenital or acquired syphilis probably accounts to some extent for this rather unexpected result.

There were 68 males and 9 females in this series, giving a ratio of 7.5 males to one female. This is a higher sex ratio than usual. The age incidence was not unusual: ten in the third decade, twenty-six in the fourth, twenty-four in the fifth, fifteen in the sixth, and two in the seventh decade of life. The youngest patient was 31 and the oldest 72 years of age.

Classified according to location, there were 71 aneurysms of the arch and ascending portions, four of the abdominal aorta, and only two of the descending thoracic aorta below the arch.

Postmortem examinations were done in only 15 of these cases. They confirmed the

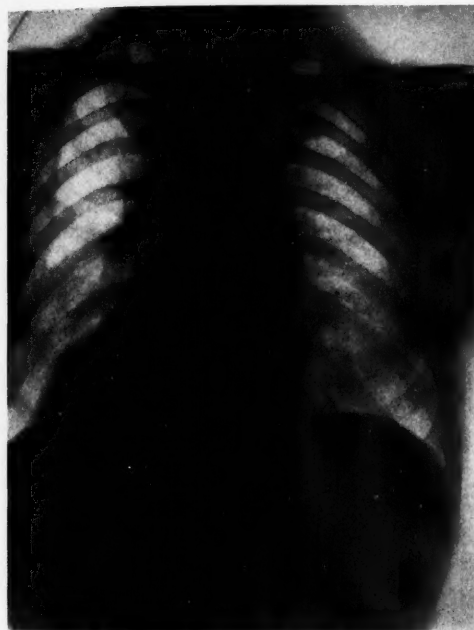


Fig. 1, Case 1. Diffuse or dilatation aneurysm of the arch and ascending aorta.

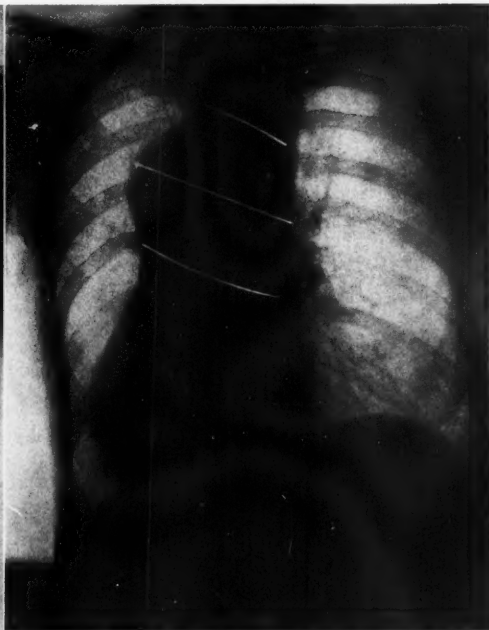


Fig. 2, Case 2. Aneurysm of the arch. The aortic oval of Kienböck is outlined. Note that the long axis runs from right and below to left and above.

final clinical diagnosis in all but two instances (Cases 3 and 4), and also discovered two early dissecting aneurysms not suspected on clinical or roentgen examinations. Such a small number of proved cases is obviously inadequate to give any indication of the relative accuracy of the clinical methods of diagnosis.

In order to determine as far as possible the part played by the roentgen study in arriving at the final diagnosis, the cases were grouped into four classes. In the first class were placed those cases in which the clinical history and examination had suggested the possibility of aortic aneurysm, and the roentgenographic study had confirmed and given definite validity to the clinical impression. In this group were placed 42 cases, or 54.5 per cent, so that it constituted the most numerous one, as might be expected. In the second class were

placed those in which the clinical examination had raised no question of aortic aneurysm, and in which an aneurysm was demonstrated during the roentgen study undertaken for other reasons. Twenty-two cases, or 28.5 per cent, fell into this group. In the third group were placed those in which the diagnosis was made entirely upon the clinical findings, the roentgen examination being negative or entirely omitted. Nine cases, or 11.5 per cent, were included in this class, in four of which no roentgenographic study was made, while the remaining five were negative roentgenographically. The basis on which these diagnoses were made is not very clear, as it is certainly not in accord with present conceptions to make a definite diagnosis of aortic aneurysm without the confirmation of X-ray studies. Finally, in the fourth group were placed those cases in which the diagnosis of aortic

aneurysm had not been made by either clinical or roentgen study, but in which aortic aneurysm was found at autopsy. Four cases, or 5.2 per cent, constituted this classification. Two of them were early cases of dissecting aneurysm which were nearly microscopic in extent. The other two will be described later (Cases 3 and 4).

This analysis indicates that the roentgen study is not only necessary to make a definite diagnosis in clinically suspicious cases, but that it is also the means of discovering a large number of cases (nearly 30 per cent) in which the existence of an aortic aneurysm had not previously been even considered.

The following cases have been selected with the purpose of illustrating both the usual types of aneurysm, and the difficulties which may occur in diagnosis.

CASE REPORTS

Case 1 (No. 155,277). A male, aged 62, complained of dyspnea, palpitation, and attacks of chest pain, of six months' duration, and occurring chiefly on exertion. The physical examination showed unequal pupils and slightly increased retrosternal dullness. The Wassermann reaction was 4 plus, and a provisional clinical diagnosis of aortic insufficiency was made. The roentgen study showed marked widening of the ascending and arch portions of the aorta, and a report of probable diffuse aneurysm was made. In view of this finding the clinical diagnosis was changed to aortic aneurysm and the patient was discharged on potassium iodide and mercury rubs.

This is a good example of the diffuse (or dilatation) aneurysm which, while it cannot be distinguished with certainty from uncomplicated aortitis, should be classed as aneurysm because of the extent to which the dilatation has progressed, and also because of the progressive enlargement which occurs until a stabilizing point is reached.

Case 2 (No. 169,551). A female, aged

68, complained of attacks of coughing and dyspnea, and loss of weight. Dyspnea on exertion had been present for fifteen years. The symptoms showed marked increase in intensity about one year before admission, and a dull, boring pain appeared in the epigastrium. The sputum was profuse but not bloody. No tubercle bacilli were found. Examination showed many râles in the chest and no increase in substernal dullness. The Wassermann was 4 plus. At the conclusion of the outpatient examination the case was provisionally considered to be one of pulmonary tuberculosis and bronchiectasis, but the roentgen examination showed a large aneurysm of the aortic arch, with displacement of the esophagus to the right and dilatation above and below the arch. The diagnosis was changed to aortic aneurysm and slight symptomatic relief was obtained by ephedrine and atropin.

This case illustrates the close resemblance which cases of aortic aneurysm may have clinically to pulmonary tuberculosis. The cough, sputum, and dyspnea are all the result of pressure on and irritation of the trachea and larger bronchi. In many cases of this kind intermittent small hemorrhages of the respiratory tract are present, thus increasing the probability of tuberculosis being diagnosed.

Case 3 (No. 244,370). A female, aged 45, complained of dyspnea, loss of weight, pain in the left chest, and aphonia. The pain had first appeared about twelve years before admission, and was constant, dull, and boring in quality. The voice had been lost two years before, and a hundred pounds in weight had been lost in the period of two years. Examination showed marked dyspnea and sluggish pupils. There was complete flatness of the entire left chest on percussion. The Kahn reaction was 4 plus. The provisional diagnosis was chronic myocarditis, with question of pleural fluid or tumor of the left chest.



Fig. 3, Case 3. Complete atelectasis of left chest from the pressure of an aneurysm of the descending aorta.



Fig. 4, Case 4. Aortitis and primary bronchial carcinoma. Aneurysm of descending aorta not visible.

Roentgenographic examination showed complete obscuration of the left lung and mediastinum, without any displacement or retraction of the mediastinum. Because of the lack of mediastinal displacement the findings were thought to indicate a tumor of the left lung or pleura. The patient was too ill for further roentgen study. Bronchoscopy showed paralysis of both vocal cords, and a large mass bulging into the trachea from the left and below. Bronchoscopy was repeated two days later to obtain a biopsy specimen, and the patient died a few hours later from the general effects of the operation. The final clinical diagnosis was mediastinal mass and neoplasm of the left lung. Postmortem examination showed a large saccular aneurysm of the lower part of the descending arch and the upper part of the descending thoracic aorta, which completely compressed the left main bronchus. The left lung was atelectatic and showed diffuse

fibrosis. There was marked erosion of the third to seventh thoracic vertebræ. In addition, there was a mediastinal abscess which extended up into the neck along the fascia, and probably originated from pressure suppuration of the left bronchial nodes.

This case is interesting in that the atelectasis was masked by the failure of the mediastinum to be displaced to the affected side, as usually occurs, and the obscuration was therefore attributed to a neoplasm. It seems, however, retrospectively, that the positive Kahn and the long duration of the pain should have been hints in the right direction.

Case 4 (No. 156,807). A male, aged 38, a negro laborer, complained of pain in the feet and legs of two months' duration. There was a history of recent gonorrhea and a positive Wassermann reaction. Examination was negative, although gonorrheal spurs of the os calcis were diagnosed. Three



Fig. 5, Case 4. Appearance of chest one month later. Spread of carcinoma clearly shown.



Fig. 6, Case 4. Lateral view showing scalloping of anterior surfaces of two vertebrae from the pressure of an aneurysm of the descending thoracic aorta just above the diaphragm (arrow).

weeks later the patient returned and there was then noted a slight increase in retrosternal dullness, and slight dullness at both apices. The liver was large and hard. X-ray examination at this time, November 26, 1926, showed what was thought to be a diffuse aneurysm of the arch, with enlargement to the right. A change in contour of the anterior surfaces of the lower thoracic vertebrae was noted, but was not thought to be due to aneurysmal pressure. The clinical diagnosis at this time was syphilis of the aorta, with aneurysm, and syphilis of the liver.

The patient returned again on December 26, 1926, as an emergency case, with greatly increased symptoms. The liver had become very large; dyspnea was marked, and the neck veins were distended. The retrosternal dullness was much increased. X-ray examination at this time showed a great change

in the chest condition. The shadow which had projected to the right and was thought to be an aneurysm was much larger, and in addition there were opacities in the right lower lung and in both hila. These were thought to be evidence of metastatic malignancy in the lung. The esophagus was examined and found to be pressed forward by a mass in the lower mediastinum. The patient died soon after (January 11, 1927), the final diagnosis being syphilis, diffuse aneurysm of the ascending aorta and arch, and probable metastatic malignancy in liver and lungs.

The postmortem examination revealed, however, a primary carcinoma of the right main bronchus infiltrating the right lung, with metastases to the liver, and an aneurysm of the lower part of the descending thoracic aorta, with erosion of the lower thoracic vertebrae.

This is an unusual and difficult case, because both a primary lung carcinoma and an aneurysm were present. The whole aorta was moderately dilated from syphilitic aortitis and the shadow of the lung tumor had a very smooth border, so that it was mistaken for an aneurysm. This very unusual smoothness of the infiltrating border was no doubt the real cause of the mistaken diagnosis which was made, although the border also had a quite remarkable continuity with the aortic shadow. The erosion of the vertebrae seen in the lateral views, and the displacement forward of the esophagus, were highly suggestive of aneurysm in this region.

SUMMARY AND CONCLUSIONS

1. Comparative clinical and autopsy statistics indicate that many cases of aortic aneurysm are not diagnosed during life.

2. Sacculated aneurysms, while the most common, are not the only type of aortic aneurysm, and the roentgen diagnosis should not be made contingent on finding local sacculations.

3. All cases of syphilitic aortitis with dilatation should be kept under observation until it has been determined by the progress of the lesion whether or not the aortitis is complicated by aneurysm formation.

4. Squaring of the aortic arch is characteristic of syphilitic aortitis.

5. A study of 77 cases of aortic aneurysm occurring during a five-year period demonstrated the percentage of occurrence rate to be 0.06 per cent, that the proportion of syphilitics with aortic aneurysm was 1.6 per cent, and that of the total number of aneurysms 97 per cent were of syphilitic origin.

6. The roentgen examination discovers a large number of cases of aortic aneurysm (nearly 30 per cent of this series) which produce no clinical signs or symptoms of their presence.

BIBLIOGRAPHY

- (1) OSLER, SIR WILLIAM: *Modern Medicine*. Lea and Febiger, 1927, IV, 840.
- (2) LUCKE, B., and REA, M. H.: *Studies on Aneurysms. I.—General Statistical Data on Aneurysm*. Jour. Am. Med. Assn., 1921, LXXVII, 935-940.
- (3) BOYD, L. J.: *A Study of Four Thousand Reported Cases of Aneurysm of the Thoracic Aorta*. Am. Jour. Med. Sci., 1924, CLXXIII, 654-668.
- (4) LEMANN, I. I.: *Aneurysm of the Thoracic Aorta: Its Incidence, Diagnosis, and Prognosis: A Statistical Study*. Am. Jour. Med. Sci., 1916, CLII, 210-218.
- (5) LEVINE, S. A.: *The Diagnosis of Syphilitic Aortitis with Negative Wassermann Reactions*. Am. Heart Jour., October, 1930, VI, 116-120.
- (6) ALBUTT, SIR CLIFFORD: *Diseases of the Arteries, Including Angina Pectoris*, 1915, II, 148-167.
- (7) BROWN, G. E.: *Syphilitic Aortitis and Its Early Recognition*. Am. Jour. Med. Sci., 1919, CLI, 41-50.
- (8) LONGCOPE, W. T.: *Syphilitic Aortitis—Its Diagnosis and Treatment*. Arch. Int. Med., 1913, XI, 15-51.
- (9) LAMB, A. R.: *Blumer's Bedside Diagnosis*, 1928, II, 625.
- (10) THOMA, J.: *Untersuchungen ueber Aneurismen*. Virchow's Archiv., 1888, CXI, 76.
- (11) OSLER, SIR WILLIAM: *Modern Medicine*, 1927, IV, 850.
- (12) KAUFMANN, E.: *Pathology for Students and Practitioners*, 1929, I, 132.
- (13) LUCKE, B., and REA, M. H.: *Studies on Aneurysms. II.—Aneurysm of the Aorta*. Jour. Am. Med. Assn., Oct. 6, 1923, LXXXI, 1167-1172.
- (14) SCOTT, R. W.: *Oxford Medicine*, 1920, II, Part II, 501.
- (15) NEUHOF, S.: *Diagnosis, Symptomatology, and Therapy of Dilatation Aneurysm of the Descending Thoracic Aorta*. Am. Jour. Med. Sci., 1916, CLI, 715-727.
- (16) BAETJER, F. H.: *The X-ray Diagnosis of Thoracic Aneurysm*. Johns Hopkins Hosp. Bull., 1906, XVII, 24-27.
- (17) KÖHLER, A.: *Roentgenology (English Translation of the Fifth German Edition)*, 1928, p. 372.
- (18) DANN, D. S.: *The Uncoiled Aorta. Part I.—The Normal Aorta*. Am. Jour. Roentgenol. and Rad. Ther., April, 1930, XXIII, 358-372.
- (19) HAMPTON, A. O., and JONES, T. D.: *A Clinical and Roentgenological Study of the Aorta, with Special Reference to Luetic Aortitis*. Am. Jour. Roentgenol. and Rad. Ther., April, 1930, XXIII, 390-395.
- (20) DANN, D. S.: *The Uncoiled Aorta. Part II.—The Pathologic Aorta*. Am. Jour. Roentgenol. and Rad. Ther., August, 1930, XXIV, 154-162.
- (21) ROSENBAUM, G.: *Aneurysm of the Horizontal Aortic Arch, with Autopsy*. Am. Jour. Roentgenol. and Rad. Ther., November, 1930, XXIV, 558-561.
- (22) WESSLER, H., and JACHES, L.: *Clinical Roentgenography of Diseases of the Chest*, 1923, p. 461.

- (23) SAMUEL, E. C.: The Roentgen Diagnosis of Aneurysm of the Aorta. *Am. Jour. Roentgenol. and Rad. Ther.*, April, 1924, XI, 361-363.
- (24) RIGLER, L. G.: The Visualized Esophagus in the Diagnosis of Diseases of the Heart and Aorta. *Am. Jour. Roentgenol. and Rad. Ther.*, June, 1929, XXI, 563-571.
- (25) YLVISAKER, R.: Two Cases of Massive Collapse of the Lung Due to Aortic Aneurysm. *Minnesota Med.*, July, 1928, XI, 483-487.
- (26) FRANCIS, B. F.: Small Aneurysm Pressing on Left Bronchus, with Complete Collapse of the Lung. *Missouri St. Med. Assn. Jour.*, 1928, XXVI, 134-136.
- (27) BACH, F., and WORSTER-DROUGHT, C.: The Interrelation of Neurosyphilis and Cardiovascular Syphilis Based on Study of 50 Cases. *Lancet*, Nov. 22, 1930, II, 1113-1115.
- (28) KURTZ, C. M., and EYSTER, J. A. E.: Fluoroscopic Studies of the Heart and Aorta in Acquired and Congenital Syphilis. *Am. Heart Jour.*, October, 1930, VI, 67-76.
- (29) STEEL, D.: The Roentgenological Diagnosis of Syphilitic Aortitis: A Review of Forty Proved Cases. *Am. Heart Jour.*, October, 1930, VI, 59-66.
- (30) CARMAN, R. D.: The X-ray Diagnosis of Thoracic Aneurysms. *Jour. Missouri St. Med. Assn.*, 1912, IX, 389-392.
- (31) KIENBÖCK, R.: Zur roentgenologischen Differentialdiagnose der Aortenaneurysmen und mediastinal Tumoren. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1926, XXXIV, 849-873.
- (32) VAQUEZ, H., and BORDET, E.: The Heart and Aorta. Second Edition, English translation, 1920, p. 231.
- (33) KIENBÖCK, R., and WEISS, H.: Ueber das entzündliche Perikard-Divertikel. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1929, XL, 389-418.

Harmful Effects of Irradiation. Med. Jour. Australia, Feb. 14, 1931, I, 204.

Chronic nephritis, the result of X-radiation, has been produced experimentally and observed clinically. Warthin noted the presence of large deposits of lime salts in the tubules of the kidneys, and Rolleston has suggested that this may have arisen from the mobilization of calcium from irradiated bones. If this be true, the damage to an organ, such as the kidney, may occur without local irradiation.

Impaired development of the progeny of rats produced by irradiation may be transmitted, according to Mendelian laws, through many generations. Irradiation of a woman's

pelvis in early pregnancy may cause the death of the fetus, retarded development of the offspring, or defects such as subnormal mentality or even microcephaly. There may thus be danger in the application of X-rays in the diagnosis of pregnancy. Irradiation for the production of temporary sterility is strongly condemned.

The possible stimulation of the growth of malignant cells, claimed by Sampson Handley and others, is considered, together with Rolleston's conclusion that the stimulating effect of radiation on malignant growths cannot be regarded as established.

J. G. STEPHENS, M.B., D.M.R.E.

THE RELATIONS OF THE ANTRUM AND CAP TO THE GALL BLADDER; GASTRIC AND DUODENAL PERISTALSIS AS FACTORS IN EMPTYING THE GALL BLADDER¹

By NATHAN B. NEWCOMER, M.D., ELIZABETH NEWCOMER, M.D., and
CHESTER A. CONYERS, M.D., DENVER, COLORADO

AFTER a controversy covering several years in regard to the emptying of the gall bladder, certain facts are now generally accepted, while others are still in dispute.

Accepted Facts.—The gall bladder empties through the cystic duct into the common duct, thence into the duodenum.

The Heisterian valves do not furnish serious obstruction to the passage of bile in either direction.

There is a sphincter at the outlet of the common duct, the sphincter of Oddi, the function of which is to interpose a moderate barrier to the continuous passage of bile into the duodenum, thus allowing the gall bladder to fill. When the action of the sphincter is destroyed by inserting a cannula or by other means, the gall bladder does not fill. When the gall bladder is absent in animals or is occluded or removed by surgery in man, the secretory pressure overcomes the sphincter, the resistance of which is very low or absent under these conditions, and bile passes continuously into the duodenum.

There would be no pressure in the biliary system if it were not for secretory pressure. The secretion of bile is more or less continuous but is more active during gastric digestion. The secretory pressure of the bile is equalized by the removal of the fluid element of the bile by the gall bladder so that the pressure of the bile is below the threshold of the sphincter of Oddi when it is intact.

Bile passes into the duodenum intermit-

tently, by spurts, during the presence of food in the stomach and in small amounts occasionally during coughing, deep respiration, straining, etc. Immediately upon taking food, the pressure in the gall bladder is raised, and in a short time the gall-bladder bile (black bile) passes by spurts into the duodenum.

The function of the gall bladder is to receive, store, and concentrate the bile, to act as an equalizer of pressure in the bile duct system, and to deliver the bile periodically during early digestion into the duodenum. It does not normally empty in appreciable quantities when the stomach is empty.

Points in Controversy.—There is considerable controversy over the rôle of the following factors in emptying the gall bladder: Muscular development of the gall bladder and the efficiency and nature of its contraction; elastic recoil; respiration; engorgement of the liver; dilution and interchange of bile in the gall bladder; variations in intra-abdominal pressure; influence of the nerve supply on the gall bladder and reciprocal action with the sphincter of Oddi; a gall-bladder hormone (cholecystokinin of Ivy and Oldberg), and intestinal peristalsis.

Subjects Discussed in This Article.—There has been little or no discussion in the literature on the relation of the gall bladder to the antrum and cap, of the variations in the position of the gall bladder when the stomach is full and when it is empty, and of the relation of the antrum and cap to the gall bladder during peristalsis with a liquid meal and with a solid meal. Too little attention has been paid to the alterations in shape the gall bladder undergoes at the time of

¹Read before the Radiological Society of North America at the Sixteenth Annual Meeting, at Los Angeles, California, Dec. 1-5, 1930.

gastric peristalsis, and to the mechanical relations of the antrum and cap to the gall bladder at that time. The object of this paper is to demonstrate these relations and to

Without secretory pressure there would be no pressure in the entire tract. To determine secretory pressure, it is necessary to exclude the gall bladder, as absorption of the fluids

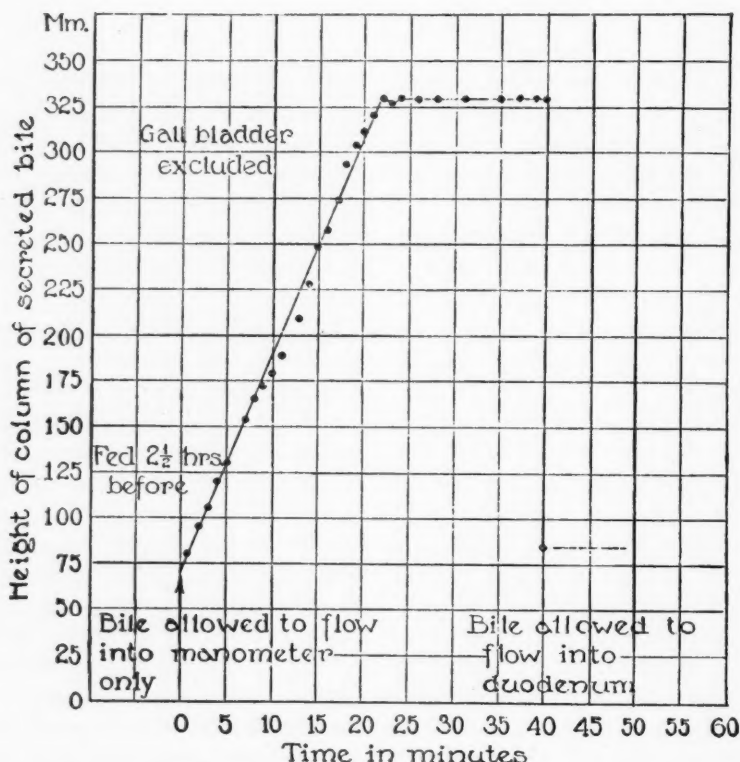


Fig. 1. The maximum secretion pressure of bile and its rate of formation in the presence of a pressure obstacle. The dots record the actual observations on an animal. It will be seen that the rate of secretion was unaffected by the increasing pressure obstacle.²

explain their rôle in emptying the gall bladder.

We would like to present the following short review concerning secretory pressure and pressure in the common bile duct and gall bladder, taken largely from McMaster and Elman (40).

SECRETORY PRESSURE

Bile is secreted more or less continuously, but more profusely during gastric digestion.

by the gall bladder occurs rapidly: in dogs, it has been found by various observers to be from 200 to 320 mm. of bile when all outlets are excluded. The time necessary to reach this point is from 15 to 30 minutes. The rate of secretion does not vary until the maximum pressure is reached, when it stops at once.²

²The following graphs (Figs. 1, 2, and 3) are taken from a reprint, "On the Expulsion of Bile by the Gall Bladder, and a Reciprocal Relationship with the Sphincter Activity," by Philip D. McMaster, M.D., and Robert Elman, M.D.

From 60 to 70 mm. of pressure causes bile to enter the gall bladder in the anesthetized dog, and 100 mm. in the unanesthetized dog during the next four hours equaled that of a column of bile about 125 mm. in height. There were frequently

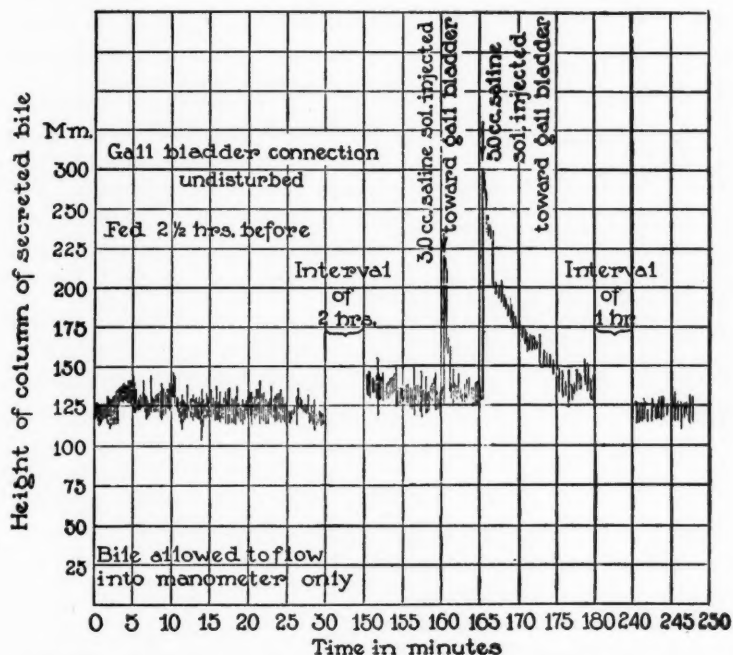


Fig. 2. The pressure developing during the first few hours of total biliary obstruction in an animal with the gall-bladder connections left undisturbed. Contrast with Figure 1. The manometer was connected with the common duct for over four hours.

thetized dog. The resistance to the passage of bile through the common duct sphincter in the normal animal fed from four to twelve hours previously is sufficient to support a column of bile from 100 to 120 mm. in height, and in the fasting animal from 250 to 300 mm. high. Immediately after taking food and again later during the process of digestion, the resistance is lowered to from 50 to 80 millimeters.

Quoting directly:

Two and one-half hours after feeding, the pressure that developed and was maintained

repeated rapid but slight, incidental fluctuations due to respiratory movements. Usually the column then rose or fell about 10 or 15 mm., occasionally, on a deep breath, 20 to 30 millimeters.

Immediately after the first swallows of food an abundant gush of far darker and more viscid bile suddenly flowed into the graduate, pointing to a discharge from the gall bladder.

Food was then offered to the animal and it was allowed to eat for 2½ minutes, consuming in this time about 150 grams. Almost at once the bile column in the manometer, registering pressure changes within the gall blad-

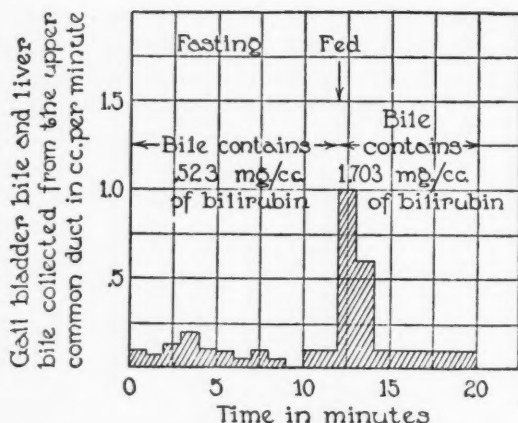


Fig. 3. Food as a stimulus to the discharge of bile from the gall bladder. Bile was collected from the upper common duct draining both liver and gall bladder. The gall-bladder connections had been left undisturbed. When food was given, a large amount of viscid and highly pigmented bile was voided, practically at once. The differences in the amount and nature of the bile collected point to a discharge of bile from the gall bladder.

der, rose to over 200 mm., and it returned again slowly toward its previous level in the course of the next 8 minutes, reaching 115 mm. and there remaining. In the meantime food was removed. The column of bile in the manometer remained level until, 17 minutes later, food was again offered. Soon after eating, the bile rose above the 250 mm. level, overflowed the manometer, and the experiment was discontinued.

It is noteworthy that in these two experiments, and in all similar ones as well, there was no sudden gush of bile from the liver, the increase in bile secretion after feeding being very gradual.

In some of our experiments the column of bile in the tube connected with the gall bladder rose abruptly when the animal had taken not more than 150 gm. of food into a stomach previously empty. In several experiments the rhythmic recurrence of abrupt increases in pressure within the gall bladder, in the absence of any further ingestion of food, rules out the possibility that a generalized increase in intra-abdominal pressure was the direct cause of the phenomenon.

MUSCULAR DEVELOPMENT OF THE GALL BLADDER AND THE EFFICIENCY AND NATURE OF ITS CONTRACTIONS

The most obvious method of approach to the question of the emptying of the gall bladder is a study of its musculature.

Histological Considerations.—Gray's "Anatomy" (19) states:

The fibro-muscular coat, a thin but strong layer forming the framework of the sac, consists of dense fibrous tissue, which interlaces in all directions, and is mixed with plain muscular fibers, disposed chiefly in a longitudinal direction, a few running transversely.

Morris' "Anatomy" (39) calls the above-described layer, the fibromuscular layer, which consists of interlacing bundles of non-striated muscle and fibrous tissue not definitely arranged, the muscular bundles running longitudinally and obliquely.

Maximow's "Text-book of Histology" (44) states:

The Smooth Muscle Layer.—This does not form distinct layers as in the intestinal canal, but constitutes a very irregular network of longitudinal, transverse, and oblique fibers.

These descriptions do not give a very convincing picture of an actively contracting organ. The location of the gall bladder, partially buried in the liver and held there rigidly, is not conducive to free muscular contraction.

What evidence direct or indirect have we that the gall bladder empties by its own contractions?

Boyden (6) and others have reported tracings of serial cholecystograms showing a gradual decrease in the size of the gall-bladder shadow after the ingestion of egg yolk and cream, which they have attributed to typical gall-bladder contraction.³

³The accompanying illustration (Fig. 4) is taken from the article, "Behavior of Human Gall Bladder during Fasting and in Response to Food," by E. A. Boyden (6). We believe that the changes in shape of the gall bladder shown in these tracings are due to direct external pressure and not to muscular contraction.

We do not believe that X-ray negatives showing the relation of the opaque antrum and cap to the gall bladder during these changes in shape, also negatives showing the peristalsis of the antrum and cap as a cause of these changes, have been adequately considered.

What record have we of direct observation of active peristalsis in the gall bladder in man or animals?

The nature of the changes in pressure in the gall bladder is, first, a sudden rise *immediately* upon the entrance of food into the stomach. This occurs too soon to be caused by increased secretion of the liver, which is gradual. In a short time there are rhythmic changes in the pressure in the gall bladder, followed by the intermittent passage of bile in spurts into the duodenum. If these changes were due to the intrinsic musculature of the gall bladder, there would have to be a tonic contraction followed by a peristaltic contraction.

Copher, Kodama, and Graham (11) state:

There has not been an indication of an actively effective contraction of the gall bladder, such as a peristaltic movement of the intestine or evacuation of the urinary bladder, in the thousands of cholecystograms that have been made by this department in man and animals. All of the changes in size and shape of the shadows are referable to an expansile organ.

Direct fluoroscopic examination of visualized gall bladders has uniformly failed to show any evidence of a peristaltic wave; and, more important still, direct electrical stimulation of

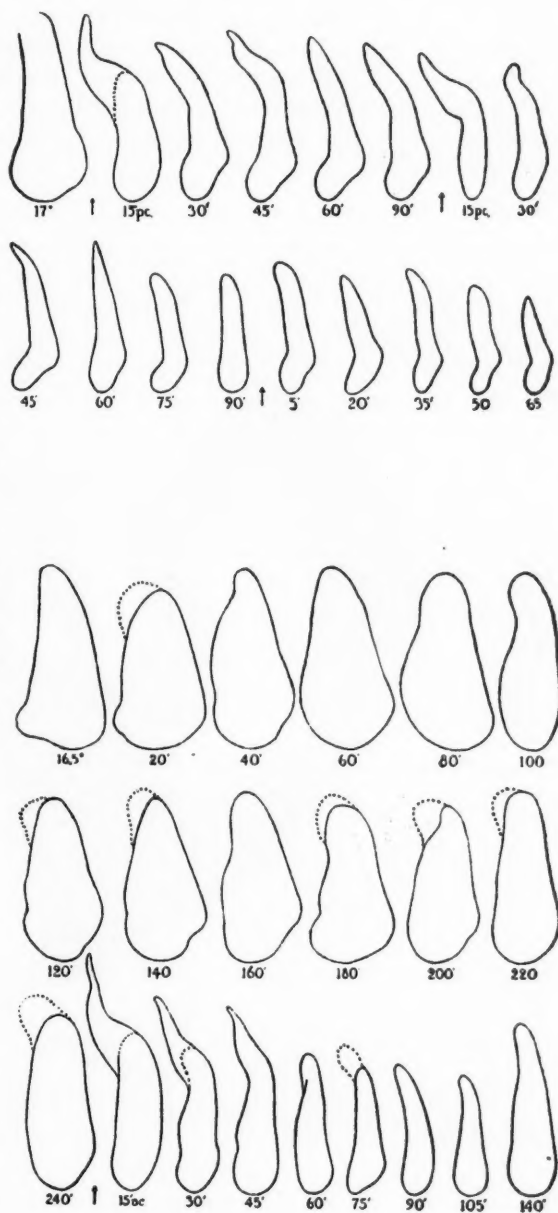


Fig. 4 (*Upper group*). Tracings of human cholecystograms ($\times \frac{1}{4}$) (Dr. L. O. Morgan), three weeks later than those shown below. First tracing (17'), gall bladder 17 hours after oral administration of iodine salts. Arrows indicate three intervals at which milk was taken. (*Lower group*) First two rows indicate changing shape of gall bladder during fasting. Dotted lines denote ampulla. Note contraction at 100'. Third row shows response to ingestion of half-pint of cream. Volume at 240', 2.85 cu. in.; at 60', 0.5 cu. in.; at 105', 0.35 cu. in. of bile.

the wall of the gall bladder of an anesthetized dog has never resulted in a contraction wave, although a similar stimulation of the intestine induced a violent peristaltic contraction. This agrees with a previous observation by Boyden and Whitaker.

tice gastric peristalsis during operation, but Moynihan (43), with his enormous surgical experience, states:

I have watched the gall bladder many hundreds of times during operation, and have

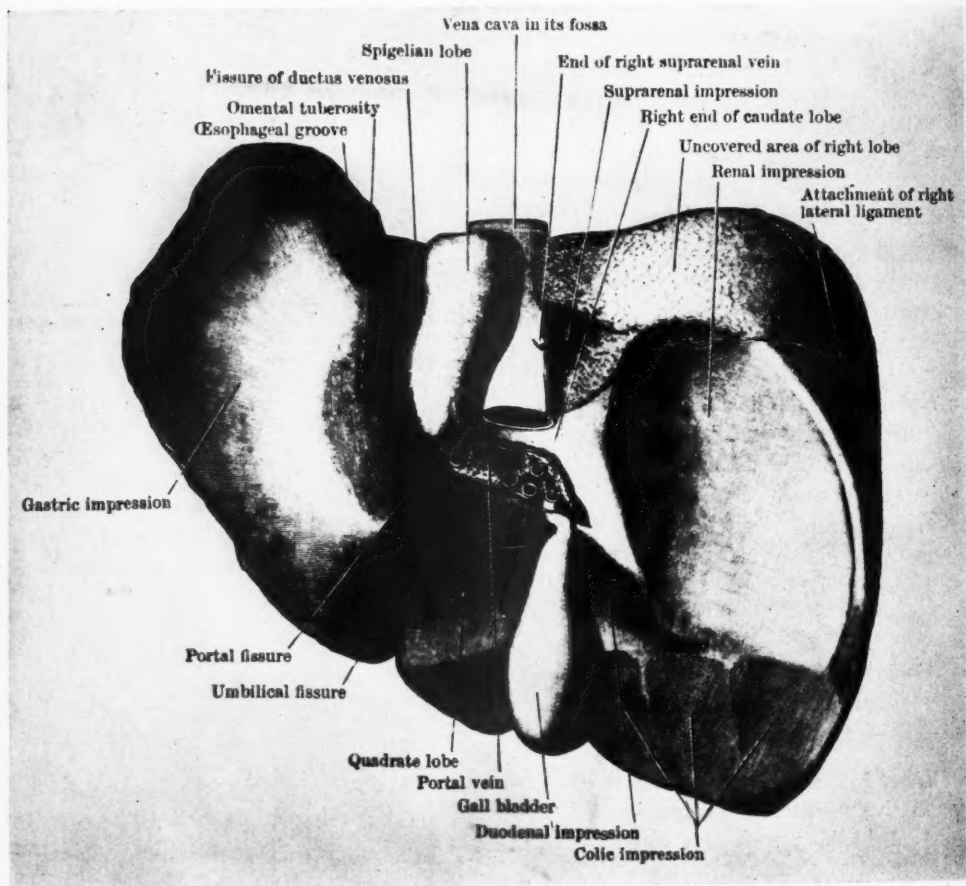


Fig. 5. Showing the relation of the antrum and cap to the gall bladder. During peristalsis, the antrum bulges out and presses the gall bladder against the liver. (From Cunningham's "Anatomy.")

We also see from the above quotation that electrical stimulation of the gall-bladder walls does not produce contraction of that organ as in other smooth muscle tissue.

It is not uncommon for the surgeon to no-

never seen anything approaching a tonic or peristaltic contraction. Very rarely one does see evidence of life. The fundus of the gall bladder or the wall near the fundus may show a movement that is best described as "wrinkling"; a part of the wall puckers after

pressure has for some time been put upon it in order to cause the bile to flow into the duodenum. But this action is slight and transient and incapable of producing any notable effects upon the contents.

ELASTIC RECOIL

Emerson and Whitaker (15) state:

With any sphincteric action of the intestinal musculature at the termination of the common duct prevented by an inlying cannula, the gall bladder shows no emptying for hours, but when the animal is fed it expels its contents in a normal manner.

This proves that the elasticity of the gall bladder does not empty its contents.

INFLUENCE OF THE NERVE SUPPLY ON THE GALL BLADDER

Denervating the gall bladder does not prevent its emptying if a meal is given. Whitaker (61) found, after a serious attempt to denervate the gall bladder, that egg yolk and cream would lead to gall-bladder evacuation.

Higgins and Mann (21) state:

Dogs in which the gall bladder has been entirely denervated, continued to respond to the fat diet in the normal way.

Whitaker and Boyden (57) report:

Further experimentation shows that the emptying of the gall bladder is not due primarily to reflex action, since the denervation of the organ does not inhibit its emptying after the ingestion of egg yolk.

Whitaker (61) also states that electrical stimulation of either vagus does not empty the gall bladder. He also says in the same article:

It does not seem justifiable to state that



Fig. 6. Tracings of X-ray films, showing the change in shape and position of the same gall bladder; (I) before eating, (II) after eating.

nerves have nothing to do with the action of the gall bladder, and yet, since the gall bladder functions normally after vagi and splanchnics are cut, and even after all the nerves in the lesser omentum are severed, it is safe to say at least that extrinsic nerves play no *essential* rôle in the mechanism for emptying the gall bladder.

RECIPROCAL RELATIONSHIP BETWEEN THE GALL BLADDER AND THE SPHINCTER OF ODDI

Careful work by Elman and McMaster (14) seems to establish a slightly fluctuating threshold pressure of the sphincter of Oddi of from 100 to 120 mm., in unanesthetized,

recently fed dogs before the flow started, and the flow always ceased at the 80 to 90 mm. level. These tests were taken between four and twelve hours after eating. Fasting twenty-four to seventy-two hours raised the

threshold from 200 to 250 mm. pressure. At the mere sight of food, the column of bile suddenly dropped, and the actual eating of food brought a further drop. In this connection, it is well to remember that hunger

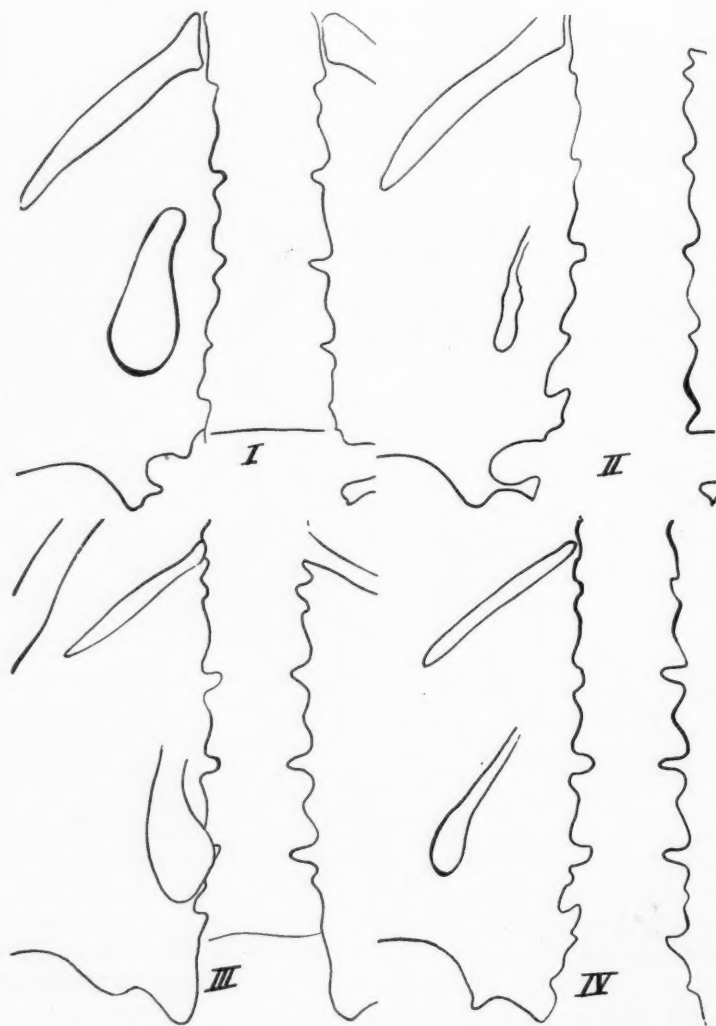


Fig. 7. Tracings of visualized gall bladders. Note that as they empty they are flattened laterally as though external pressure was exerted upon them, but not shortened. Most of the muscular fibers are longitudinal and their action should shorten the gall bladder. I and II are of one individual; III and IV of another individual. I and III are taken with the stomach empty; II and IV after a solid meal. Note the change in position and shape after eating.

pains are due to gastric peristalsis, also that the variations in the tonicity of the sphincter of Oddi, which is a thickened portion of the duodenal musculature, might well be a part

Also Lueth, Ivy, and Kloster (33) reported:

We have observed a number of dogs in

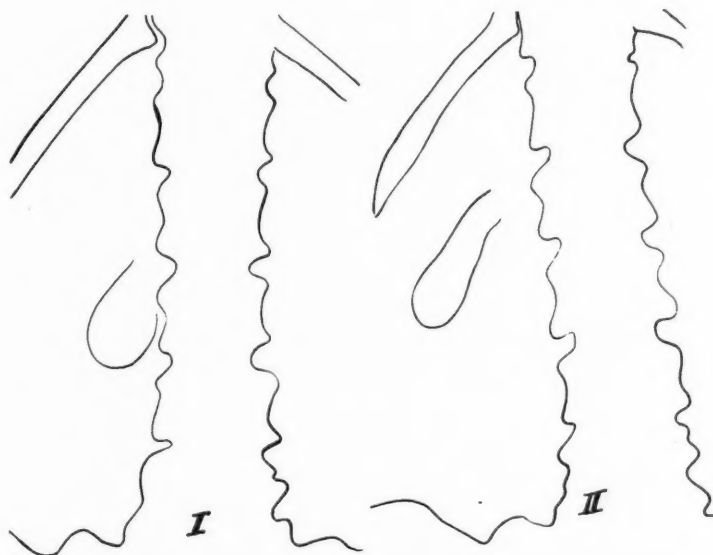


Fig. 8. Tracings of X-ray films of visualized gall bladder: (I) Gall bladder before eating; (II) gall bladder after eating. Note change in shape and position.

of the contraction and relaxation occurring during duodenal peristalsis and not due to a reciprocal action.

GALL-BLADDER HORMONE

Ivy and Oldberg (29) have been the main advocates of a gall-bladder emptying hormone, which they have called "cholecystokinin." It is derived from a highly purified secretin, produced by the action of hydrochloric acid on the mucosa of the duodenum and jejunum. The striking thing about their work is the fact that the pressure in the gall bladder remains up for a considerable time after one injection.

which the gall bladder would not relax completely after the injection of a single dose of "cholecystokinin," but would remain contracted for more than two hours.

A contraction of this type will not deliver an intermittent flow of bile by spurts. In other words, the pressure in the gall bladder is maintained at a higher level than normal for a long time.

In this connection we also quote the following from Starling (53):

The injection of 5 c.c. of a solution of secretin increased the secretion of bile by the liver from 27 drops in 15 minutes to 54 drops in 15 minutes.

Under Figure 4, in Ivy and Oldberg's (29) article, they state:

The tracing shows contraction of the gall

to evaluate the rôle that the hormone mechanism plays in gall-bladder evacuation, but it is quite certain that this mechanism is not the only one concerned.

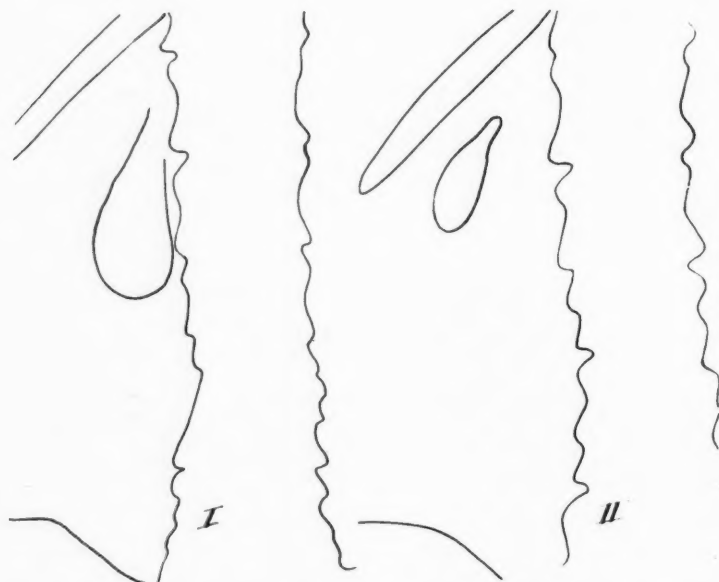


Fig. 9. Tracings of X-ray films of a visualized gall bladder in the sthenic type: (I) Shape and position of the gall bladder when the stomach is empty; (II) change in position of the gall bladder upward and outward following a solid meal.

bladder, with rhythmic contractions (approximately 3 per minute), caused by the injection into the duodenum of 50 c.c. of pancreatin-digested egg yolks and cream.

The rhythmic contractions were produced when food was injected into the duodenum.

Ivy's (27) final conclusions in April, 1930, are as follows:

Burget had found that a cholecystokinin solution will not only cause the gall bladder of the guinea pig to contract *but also the duodenum*. Kendall found that it would also cause the isolated intestine of the guinea pig to contract.

It is impossible with the evidence at hand

INTRAVENOUS INJECTIONS

According to Ivy and Oldberg (29):

Every agent we have injected which causes a fall in blood pressure has caused a contraction of the gall bladder.

Higgins and Wilhelmj (22) summarize the results of intravenous injection of fats by saying:

The results of these three methods of study are in agreement in that the gall bladders of cats and dogs do not empty when the emulsions of fat described are injected into the blood stream. Slight tonic changes which are noted are considered as insignificant and

wholly unrelated to the presence of the fat. Observations made on the gall bladders of cats, following the oral administration of the

after having decreased in size. In our experience, this seldom occurs except in pathologic gall bladders.



Fig. 10. Tracing of X-ray films of same individual: (I) visualized normal gall bladder; stomach empty; (II) visualized gall bladder after eating a solid meal; stomach visualized. Note the change in shape and position of the gall bladder after eating, and the relation of the antrum and cap to the gall bladder.

emulsions described, show conclusively that the vesicle empties in response to these foods in the gastro-intestinal tract, and, accordingly, the conclusions are manifest that contraction of the gall bladder is related to gastro-intestinal activity either of a hormone or of a nervous excitation.

THE INTRODUCTION OF AIR, FOOD, AND DRUGS INTO THE DUODENUM

The gall bladder has been shown to empty in response to substances injected into the duodenum, such as air, food, egg yolk, $MgSO_4$, etc. ($MgSO_4$ exerts the most powerful evacuative force on the gall bladder of any inorganic reagent, according to Boyden and Birch, 5), any one of which could easily cause peristalsis of the duodenum and antrum.

DILUTION OF GALL-BLADDER BILE

In X-ray examinations this is indicated by an enlargement of the gall-bladder shadow

THE RELATIONS OF THE ANTRUM AND CAP AS FACTORS IN EMPTYING THE GALL BLADDER

We have seen repeatedly that the whole problem of emptying the gall bladder is closely associated with the taking of food, and that gall-bladder bile is emptied into the duodenum early in gastric digestion intermittently by spurts.

We believe that a careful study of the relation of the antrum and cap, when filled and during peristalsis, to the gall bladder, and a study of the effects of various foods on gastric peristalsis, and the emptying time of the stomach, will aid in explaining the emptying of the gall bladder.

ANATOMICAL RELATIONS

We are quoting from Gray and Cunningham to call attention to the exact anatomic relationship of the antrum, pylorus, and duodenum to the gall bladder and the liver during the fasting stage and after a meal.

From Gray's "Anatomy" (20):

(THE STOMACH) *The Pyloric Orifice.*—Its position varies with the movements of the stomach. When the stomach is empty the pylorus is situated just to the right of the median line of the body, on a level with the upper

direction of the first portion depends upon the amount of distention of the stomach and therefore upon the position of the pylorus. When the stomach is empty and the pylorus situated at the right of the upper border of

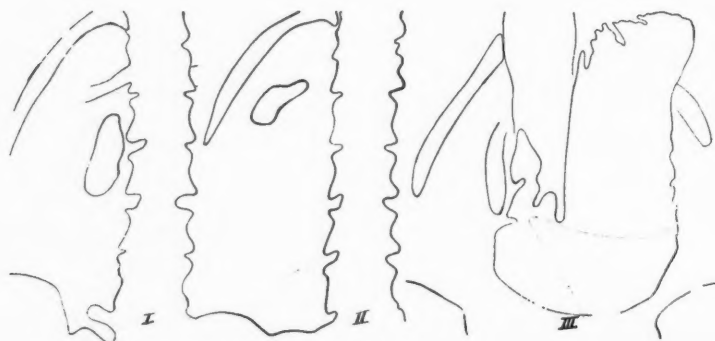


Fig. 11. Tracings of X-ray films of the same person: (I) visualized gall bladder; stomach empty; (II) visualized gall bladder; stomach filled with solid meal. Note change in shape and position after eating a solid meal. (III) Visualized gall bladder; stomach filled with barium and buttermilk. Note that the gall bladder lies nearer the midline and lower with the liquid meal than with the solid meal.

border of the first lumbar vertebra. As the stomach becomes distended the pylorus moves to the right, and in a fully distended stomach may be situated two or three inches to the right of the median line.

Alterations in Position.—When the stomach is distended its surfaces, which are flattened when the organ is empty, become convex. The greater curvature is elevated and carried forward, so that the anterior surface is turned more or less upward and the posterior surface downward, and the stomach brought well against the anterior wall of the abdomen.

When the stomach becomes distended the change in the position of the pylorus is very considerable; it is shifted to the right, some two or three inches from the median line, and lies under cover of the liver, near the neck of the gall bladder.

(THE SMALL INTESTINE) *The Duodenum.*—In the adult the course of the duodenum is as follows: Commencing at the pylorus the

the first lumbar vertebra, it is nearly horizontal and transverse, but where the stomach is distended, in consequence of the alteration of the position of the pylorus to the right the proximal end of the duodenum also becomes altered in position, while the distal end remains fixed and the direction of this portion of the bowel is now antero-posterior. Whether directed transversely or antero-posteriorly, it reaches the under surface of the liver, where it takes a sharp curve and descends along the right side of the vertebral column, for a variable distance, generally to the body of the fourth lumbar vertebra.

The first or superior portion is very variable in length, but is usually estimated as being about two inches. Beginning at the pylorus, it ends at the neck of the gall bladder. It is the most movable of the four portions. It is almost completely covered by peritoneum derived from the two layers of the lesser omentum, but a small part of its posterior sur-

face near the neck of the gall bladder and the inferior vena cava is uncovered. It is in such close relation with the gall bladder that it is usually found to be stained by bile after death, especially on its anterior surface. It is

In the gradual passage of the stomach from the empty to the distended condition we may recognize three stages.

First stage: This commences with an enlargement of the fundus, and is followed by an

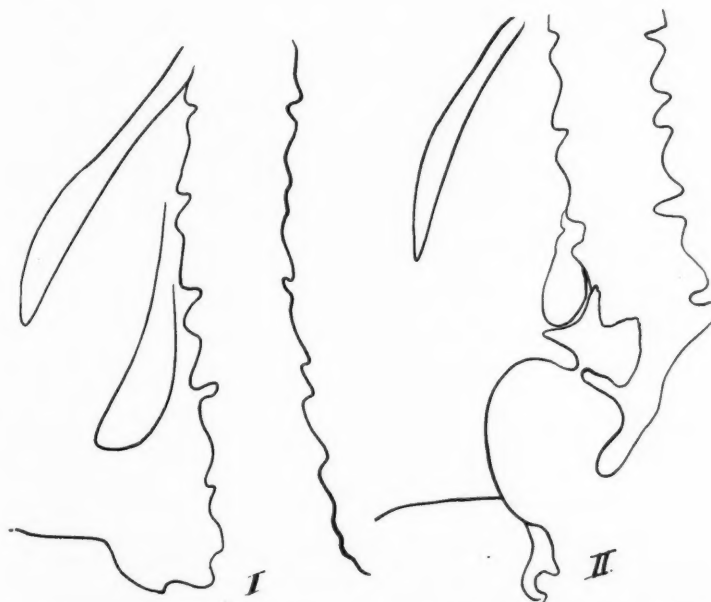


Fig. 12. Tracings of X-ray films: (I) visualized gall bladder; stomach empty; (II) the same gall bladder partially empty after a solid meal. Note (1) crescentic indentation in cap due to a pathologic gall bladder, (2) that the antrum projects well beyond the original location of the gall bladder during active peristalsis.

in relation above and in front with the quadrate lobe of the liver and the gall bladder; behind with the gastro-duodenal artery, the common bile duct, and the vena porta, and below with the head of the pancreas.

From Cunningham's "Anatomy" (12):

(THE DIGESTIVE SYSTEM) *The Stomach.*—With distention there comes a general enlargement of the various diameters, an elongation of the whole organ, with a consequent passage of its pyloric portion to the right beneath the liver, the development of the antrum pylori, and an inclination of its axis from behind downwards and forwards, without any rotation.

expansion of the whole cardiac portion, which passes upwards and also to the left towards the diaphragm, displacing the coils of the transverse colon, which lie here when the stomach is empty. The pyloric portion for three or four inches still remains contracted and cylindrical. In this condition the stomach is frequently found after death.

Second stage: As distention goes on the lesser curvature opens out, the pyloric portion (with the exception of its last inch) expands, but its junction with the cardiac portion usually remains distinct, until distention is almost complete.

Third stage: A further general expansion of the whole stomach takes place; the diameters of both cardiac and pyloric portions, as

well as the length of the organ, are increased, and the great curvature presses forward against the anterior abdominal wall in front, where the restraining influence of the ribs is absent. The pyloric end for about one inch

distention it is carried to the right beneath the quadrate lobe, and its terminal part is there directed backwards in order to reach the duodenum. Even in this condition its last inch remains comparatively undistended.

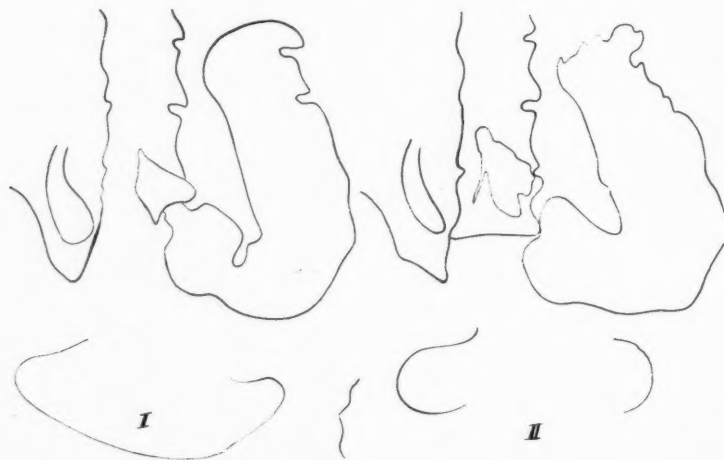


Fig. 13. Tracing of a case of marked ptosis of the stomach. Gall bladder and stomach both visualized. The gall bladder lies between the crest of the ilium and the vertebral column; the antrum and cap lie low and to the left. Such altered relations prevent the contact of the antrum and cap during peristalsis.

(2.5 cm.) from the pylorus remains narrow (constituting the pyloric canal of Jonnesco), but to the left of this it bulges forward, forming the antrum pylori, which is most distinct at the great curvature. By the increase of the organ in length the antrum is carried a considerable distance to the right beneath the liver—even farther than the pylorus itself—so that the terminal part of the stomach is bent backwards and to the left, in order to reach the pylorus, which latter very rarely passes more than one and a half or two inches to the right of its normal position, namely, in the empty condition, within half an inch (12 mm.) of the middle line.

The narrow or pyloric end, when the stomach is empty, is contracted and cylindrical, and runs transversely to the right, lying as a rule beneath the left lobe of the liver. . . . During

The Duodenum.—When the stomach is distended, the first inch of the duodenum—which is movable on account of its peritoneal covering—is carried to the right with the pylorus, and thus brought into line with the second or terminal half, which is always directed backwards. Hence the whole of the first portion of the duodenum is directed backwards when the stomach is full.

Above the colon, it is in contact with the narrow end of the gall bladder and below it with the coils of the small intestine.

Figure 5, taken from Cunningham's "Anatomy," shows the relation of the antrum and cap to the gall bladder; during peristalsis, the antrum bulges out and presses the gall bladder against the liver.

X-RAY OBSERVATIONS

Attention has been called repeatedly to the rise in pressure immediately upon the taking of food. This occurs entirely too

to eat a regular meal of solid food (meat, potatoes, bread, butter, and salad if desired), and to return in one-half to one hour for another film. We have noted as a general thing, particularly if the gall bladder be

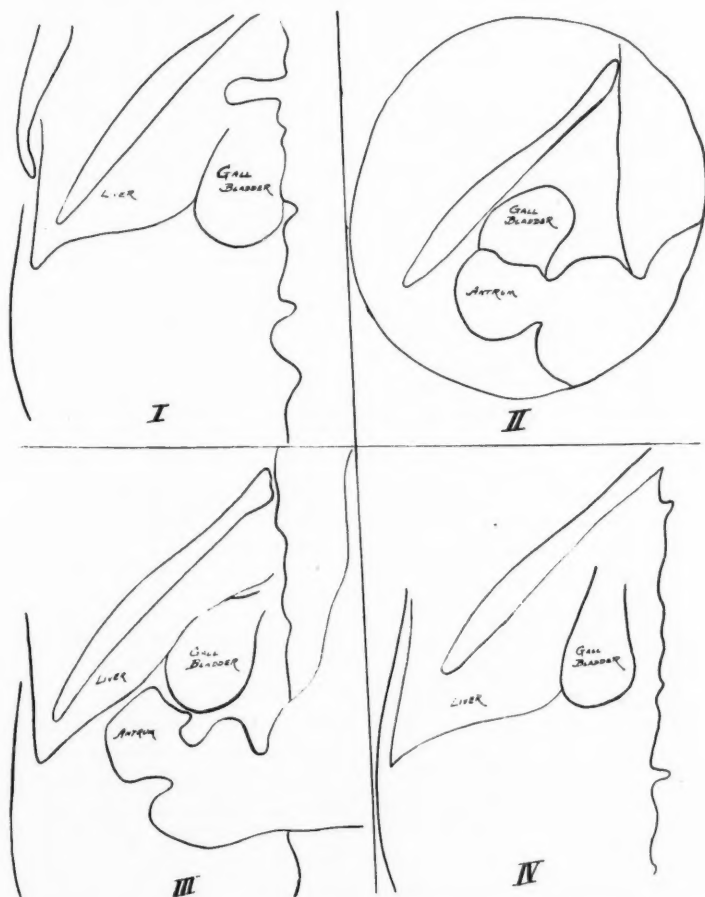


Fig. 14. Four tracings of X-ray films of same case: (I) visualized gall bladder; stomach empty; (II) change in position of gall bladder after eating; (III) note that the antrum during peristalsis does not press the gall bladder against the liver; (IV) marked retention of the dye for 24 hours.

soon to be the result of secretory pressure.

It has been our custom over a period of years to take a film six hours after the intravenous injection of sodium tetraiodophenolphthalein. We then instruct the patient

normal, that it was shifted to the right and upwards from 1 to 2 inches, and that the gall bladder generally was flattened or had a curved indentation on the side adjacent to the stomach. This corresponds with the

change in position of the antrum and cap when the stomach is distended, as described by Gray and Cunningham.

If the tension is from 100 to 120 mm. in the gall bladder when the stomach is empty,

additional pressure would be exerted on the gall bladder to cause it to empty by spurts.

According to Starling (53), the normal pressure in the duodenum is about 150 mm. of water and the pyloric intragastric pres-

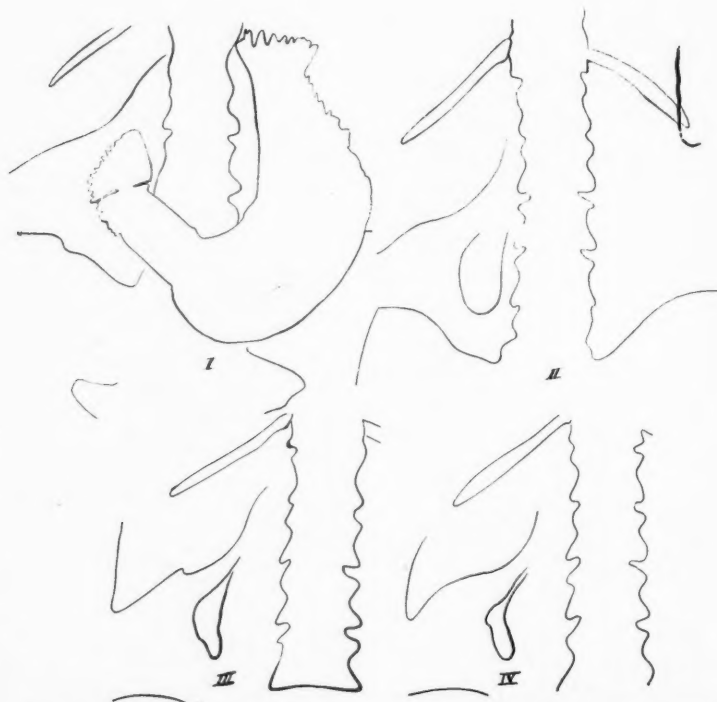


Fig. 15. Tracings of X-ray films of same individual: (I) visualized stomach and cap (note long narrow antrum); (II) visualized gall bladder; stomach empty; (III) visualized gall bladder after solid meal; (IV) visualized gall bladder, 24 hours after intravenous injection of dye. Note the association of a long narrow antrum and a gall bladder that does not empty in 24 hours. Nature apparently is trying to protect an inflamed gall bladder from the peristaltic action of the antrum.

it seems obvious that if sufficient pressure is exerted on the gall bladder by the filled stomach, antrum, and cap to shift it to the right and up against the mass of the liver which holds it rigidly, it would raise the pressure within the gall bladder *at once* upon eating. If, in addition, vigorous peristalsis of the antrum occurs, particularly if the stomach is filled with solid food, sufficient

sure 100 mm. during relaxation and from 200 to 300 mm. during an intensive wave.

The rate of the intermittent increase of pressure given by Ivy, Boyden, Higgins and Mann, and others corresponds with that of gastric peristalsis.

Higgins and Mann (22) state the following:

But entirely independent of this respiratory fluctuation was the larger range of fluctuation in the level, induced by the activity of the gall bladder itself. These larger fluctuations were variable in their extent and ranged from 20 to 40 mm. of bile at more or less varying intervals, thus suggesting a variable frequency in the rate of contraction of the muscle tunic. These intervals between successive contractions ranged from twenty to thirty seconds, the actual period of contraction being only a few seconds' duration.

GASTRIC PERISTALSIS

We quote the following from Alvarez (2) on gastric peristalsis:

In the human stomach, waves appear about once in twenty seconds.

On the lesser curvature the amplitude is very small, and in the antrum it is large.

The peculiar form of the contraction curve exhibited by the muscle in the pyloric antrum was observed even in the frog.

We have seen that distention of smooth muscle generally causes it to contract more actively.

Quoting from Templeton and Johnson (56) on hunger contractions:

Simultaneous tracings, by the ordinary manometer method, from three different portions of the stomach show hunger motility to be peristaltic. . . . Unlike the contractions in the upper portion of the stomach, that seen nearest the pylorus is not preceded by a rise in tone. The contraction is sudden and sharp.

Rehfuss (49), quoting Carlson, states:

Hunger contractions are powerful peristaltic contractions which arise at, or near, the cardiac sphincter and sweep downward over the entire stomach, so that during a typical hunger period the stomach exhibits movements which have been described by roentgenographers after the bismuth meal has been given. . . . It is generally believed that any irritant

reaching the duodenum may produce spasm at or near the pylorus.

Quoting from Birch and Boyden (3):

Faradic Stimulation of Stomach (Spontaneous Rhythm of Gall Bladder).—When previously working with cats in which the gall bladder had been filled with iodized oil, we had occasionally noted spontaneous changes in the tonus of the gall bladder during fasting.

Curiously enough, the stomach of this cat was visualized by its natural content of air, so that when films were developed it was seen that the tonus changes in the gall bladder paralleled a series of peristaltic waves that were passing over the cardiac end of the stomach.

Reflex Contraction of Gall Bladder.—Evidence that the spontaneous rhythm of the gall bladder just described was induced by peristalsis of the stomach, is indicated by the following experiment. When the pars pylorica of the stomach of the cat shown in Plate 2 was stimulated with a strong induction current, the gall bladder immediately contracted, forcing the iodized oil farther into the upper lobe than occurred under the influence of spontaneous contractions.

This experimental stimulation of the stomach seems to afford conclusive proof that vigorous contraction of the stomach induces reflex contraction of the gall bladder.

In a human case already described, the patient reported intense, subjective hunger pangs at the time that X-rays were recording pronounced emptying of the gall bladder. Previous to this Boldyreff had shown that in dogs, periodic hunger contractions of the stomach are accompanied by spurts of bile from the common duct.

Summary by Birch and Boyden.—(1) Faradic stimulation of the pars pylorica of the stomach induces sudden contraction of the relaxed gall bladder and ejection of bile into the cystic duct. (2) Hunger contractions of the stomach occur synchronously with rhythmic contractions of the gall bladder and probably account for the periodic emptying of the gall bladder during fasting.

TABLE I.—OBSERVATIONS ON FOUR SUBJECTS WITH SIX DIFFERENT MEALS*
(From Wilson, Dickson, and Singleton)

Subject	Thick porridge 240 c.c.			100 gm. dates and bread 40 gm.			140 gm. ground lean meat			120 gm. fat bacon 5 egg yolks			32 per cent cream			240 c.c. cream + 0.5 gm. hydrochloric acid		
	Percentage out in			Percentage out in			Percentage out in			Percentage out in			Percentage out in			Percentage out in		
	First Leav- ing	1½ Hrs.	3 Hrs.	First Leav- ing	1½ Hrs.	3 Hrs.	First Leav- ing	1½ Hrs.	3 Hrs.	First Leav- ing	1½ Hrs.	3 Hrs.	First Leav- ing	1½ Hrs.	3 Hrs.	First Leav- ing	1½ Hrs.	3 Hrs.
A.....	1	85	100	3	50	75	3	50	75	15	20	30	2	40	50	2	40	50
B.....	2	70	100	3	55	95	4	50	60	31	10	50	2	40	50	1	30	40
C.....	3	95	100	3	60	95	12	70	100	2	50	65
D.....	4	75	90	3	60	95	7	40	80	12	10	30	1	75	80	1	75	90

*With each meal the first column shows the time in minutes after the commencement of ingestion that barium was first seen in the duodenum. The other three columns give the percentage of the meal which has left the stomach in one and one-half, three, and four and one-half hours, respectively. Each meal totals 240 c.c. and contains 40 gm. of barium sulphate.

We do not believe that reflex contraction of the gall bladder is the correct explanation, because repeated observers (including Boyden himself) state that the gall bladder will empty when food is taken, even after the gall bladder has been completely denervated.

We are including a table by Wilson, Dickson, and Singleton (60) in regard to the emptying time of the stomach.

It is interesting to note how early carbohydrates leave the stomach and how slowly proteins and fats leave the stomach. The virtue of the fat meal in emptying the gall bladder can be explained by the length of time fats stay in the stomach, if we are right in our contention that food in the stomach raises the gall-bladder pressure nearly to the threshold of the sphincter of Oddi by direct pressure of the antrum and cap, and that gastric and duodenal peristalsis furnish the additional pressure to empty the gall bladder periodically by spurts.

The changes in shape and size of the gall bladder are synchronous with gastric peristalsis. The change in the shape of the normal gall bladder corresponds with the shape of the antrum pressing against it causing it to collapse, because the pressure in the filled stomach is greater than in the normal gall bladder.

The pathologic gall bladder, because of the pathology present, is either not compressible or the pressure required to collapse it is decidedly increased. Consequently, a crescentic or flattened indentation of the antrum or cap generally indicates a pathologic gall bladder.

In a previous article by the authors (45), the following is stated: "Indirect pressure signs, principally irregular duodenal caps, or a flattened crescentic indentation on the antrum or cap, were seen in about three-fourths of the cases diagnosed as pathologic gall bladders and in about the same percentage that were operated upon."

Fig. 16. Negatives taken of the same stomach during different stages of peristalsis. Note the bulging of the antrum and its marked shifting to the right during active peristalsis. It is this change in position of the antrum during active peristalsis which causes pressure upon the gall bladder, thus emptying it periodically by spurts.



Lack of motility of the pylorus, antrum, and cap also prevents the intimate relations of the antrum and cap to the gall bladder. Marked variations from the medium habitus, increase in weight, and pregnancy also disturb this relation and predispose to gall-bladder disease.

PREGNANCY

Mann and Higgins (38) state:

The degree of emptying in the pregnant female, however, depends on the stage of pregnancy. In animals observed in the early stages of pregnancy, slight emptying had occurred four hours after the taking of the "fat meal," although in no instance, even in early pregnancy, was the degree of emptying comparable with that of the non-pregnant animal. From about the time of the middle of pregnancy to term, there was no evidence of the emptying of the gall bladder.

A comparison of two gall bladders, one of a non-pregnant animal, which emptied, and the other of a pregnant animal, which did not empty, raises questions with regard to the so-called tests of function of the gall bladder. The gall bladder of the non-pregnant animal appeared normal grossly, and emptied and filled normally. The gall bladder of the pregnant animal appeared normal grossly but did not empty normally. Its contents showed the characteristics of stasis. Also, shortly after removal of the contents of the uterus, the gall bladder of the pregnant animal again responds normally in every respect. It is apparent that activity of the gall bladder may be influenced by factors outside the biliary tract and that the organ should neither be judged diseased nor be removed because of its response to these extraneous factors, which may be physiologic.

GALL-BLADDER PATHOLOGY AND DISORDERS OF GASTRIC PERISTALSIS

Most of the manifestations of gall-bladder pathology are associated with disorders of gastric peristalsis. The long, narrow,

rigid antrum, gastric retention, and disorders in gastric peristalsis have long been noted in gall-bladder diseases.

The occurrence of gallstone colic after heavy meals rich in fats probably is due to increased peristalsis putting extra pressure on the gall bladder. Nature produces vomiting to relieve this pressure and to protect the inflamed area. Washing of the stomach and withholding of food will relieve gallstone colic better than a hypodermic of morphine.

Birch and Boyden (63) state that faradic stimulation of the pylorus induces sudden contraction of the relaxed gall bladder and that "these observations confirm the existence of a reflex pathway extending from the splanchnic area to the gall bladder."

We believe such a reflex is unnecessary as the peristalsis of the antrum causes pressure on the gall bladder directly, sufficient to account for its emptying. Numerous investigators have demonstrated the emptying of the gall bladder by a meal when all nerves to the gall bladder have been removed. Consequently, we believe the best explanation of the emptying of the gall bladder is that it is due to the increased pressure of a filled stomach accompanied by gastric and duodenal peristalsis pushing the collapsible gall bladder against the under surface of the liver, thus emptying it by spurts early in gastric digestion, purely by mechanical means.⁴

BIBLIOGRAPHY

- (1) AUSTER, LIONEL S., and CROHN, BURRILL B.:
Notes on Studies in the Physiology of the

⁴Through the assistance of Dr. Otto S. Kretschmer, Director of our Pathological Department, we have determined that in the guinea pig and in the cat the gall bladder lies in the midline when the stomach is empty and in direct relation with the antrum and first portion of the duodenum; the empty stomach lies to the left of the midline; the gall bladder is shifted to the right and toward the head in the filled stomach. The gall bladder and stomach when injected with opaque medium definitely show this shift, also an intimate relation between the gall bladder and the antrum and cap, in the negatives taken in the posterior anterior position.

In a previous article (45), in 1927, we advocated similar views in regard to the rôle of the antrum and cap in emptying the gall bladder.

- Gall Bladder. *Am. Jour. Med. Sci.*, 1922, CLXIV, 347.
- (2) ALVAREZ, WALTER C.: The Mechanics of the Digestive Tract, 1928.
 - (3) BOYDEN, EDWARD A., and BIRCH, CARROLL L.: Reaction of Gall Bladder to Stimulation of Gastro-intestinal Tract. *Am. Jour. Physiol.*, March 1, 1930, XCII, 287.
 - (4) BOYDEN, E. A., and SAUNDERS, A. M.: Duodenal Drainage of the Human Gall Bladder. *Proc. Soc. Exper. Biol. and Med.*, 1928, XXV, 458.
 - (5) BOYDEN, E. A., and BIRCH, C. L.: Emptying of Human Gall Bladder after Saline Cathartics. *Proc. Soc. Exper. Biol. and Med.*, June, 1928, XXV, 840.
 - (6) BOYDEN, EDWARD A.: Behavior of Human Gall Bladder during Fasting and in Response to Food. *Proc. Soc. Exper. Biol. and Med.*, November, 1926, XXIV, 157.
 - (7) Idem: Concerning the Prevalent Denial of Functions Long Attributed to the Gall Bladder. *Surg., Gynec. and Obst.*, 1928, XLVI, 30.
 - (8) BURGET, G. E., and BROCKLEHURST, R. J.: The Bile-expelling Mechanism of the Guinea Pig. *Am. Jour. Physiol.*, 1927-28, LXXXIII, 578.
 - (9) BOYDEN, E. A.: Sex Differences in the Contraction Rate of the Human Gall Bladder. *Proc. Soc. Exper. Biol. and Med.*, January, 1927, XXIV, 352.
 - (10) CARMAN, RUSSELL D.: The Roentgen Diagnosis of Diseases of the Alimentary Canal, 1920.
 - (11) COPHER, GLOVER H., KODAMA, SHUICHI, and GRAHAM, EVARTS A.: The Filling and Emptying of the Gall Bladder. *Jour. Exper. Med.*, 1926, XLIV, 65.
 - (12) CUNNINGHAM, DANIEL JOHN: Text-book of Anatomy, 1905.
 - (13) DEEVER, JOHN B.: Surgical Anatomy, 1903.
 - (14) ELMAN, ROBERT, and McMASTER, PHILIP D.: The Physiological Variations in Resistance to Bile Flow to the Intestine. *Jour. Exper. Med.*, August 1, 1926, XLIV, 151.
 - (15) EMERSON, WILLIAM C., and WHITAKER, LESTER R.: The Effect of Eliminating the Sphincter of the Common Bile Duct upon Emptying of the Gall Bladder. *Am. Jour. Physiol.*, 1927-28, LXXXIII, 484.
 - (16) GRAHAM, EVARTS AMBROSE; COLE, WARREN HENRY; COPHER, GLOVER H., and MOORE, SHERWOOD: Diseases of the Gall Bladder and Bile Ducts, 1928.
 - (17) GANTT, W. HORSLEY (Baltimore), and VORBORTH, G. V. (Petrograd): The Influence of Magnesium Sulphate on the Expulsion of Bile from the Gall Bladder. *Jour. Lab. and Clin. Med.*, 1925-26, XI, 547.
 - (18) GEORGE, ARIAL W., and LEONARD, RALPH D.: The Pathological Gall Bladder, 1922.
 - (19) GRAY, HENRY: Anatomy (Edited by W. H. Lewis), 1930.
 - (20) Idem: Anatomy, Descriptive and Surgical, 1901.
 - (21) HIGGINS, G. M., and MANN, F. C.: Consideration of the Gall Bladder with Reference to the Process of Emptying. *Surg. Clin. No. Am.*, October, 1926, VI, 1241.
 - (22) HIGGINS, GEORGE M., and WILHELMJ, CHARLES M.: The Effect of Intravenous Injections of Various Emulsions of Fat on the Emptying of the Gall Bladder. *Am. Jour. Med. Sci.*, 1929, CLXXVIII, 805.
 - (23) HARER, W. B., HARGIS, E. H., and VANMETER, V. C.: Studies of the Function of the Gall Bladder. *Surg., Gynec. and Obst.*, 1922, XXXIV, 307.
 - (24) HAMRICK, ROBERT A.: The Emptying of the Gall Bladder: An Experimental Study. *Am. Jour. Med. Sci.*, 1927, CLXXIV, 168.
 - (25) IVY, A. C.: A Hormone Mechanism for Gall-bladder Contraction and Evacuation. *Am. Jour. Surg. (New Series)*, 1929, VII, 455.
 - (26) Idem: The Newer Physiology of the Gall Bladder. *Detroit Proceedings of the Interstate Post-graduate Medical Assembly of North America*, 1929, p. 378.
 - (27) Idem: The Role of Hormones in Digestion. *Physiol. Rev.*, April, 1930, X, 321.
 - (28) IVY, A. C., DREWYER, G. E., and ORNDORFF, B. H.: The Effect of Cholecystokinin on the Human Gall Bladder. *Am. Jour. Physiol.*, June, 1930, XCIII.
 - (29) IVY, A. C., and OLDBERG, ERIC: A Hormone Mechanism for Gall-bladder Contraction and Evacuation. *Am. Jour. Physiol.*, 1928, LXXXVI, 599.
 - (30) IVY, A. C.: Recent Advances in the Physiology of Gastric and Pancreatic Secretion. *Northwest Med.*, November, 1926, p. 589.
 - (31) JUDD, E. STARR, and MANN, FRANK C.: The Effect of Removal of the Gall Bladder. *Surg., Gynec. and Obst.*, 1917, XXIV, 437.
 - (32) KRAUSE, WILLIAM F., and WHITAKER, LESTER R.: Effects of Different Food Substances upon Emptying of the Gall Bladder. *Am. Jour. Physiol.*, 1928-29, LXXXVII, 172.
 - (33) LUETH, H. C., IVY, A. C., and KLOSTER, G.: Further Observations on the Action of "Cholecystokinin." *Am. Jour. Physiol.*, December, 1929, XCI, 332.
 - (34) LYON, B. B. VINCENT: Can the Gall Bladder Empty through Duodenal Biliary Drainage? Is the Gall Bladder the Source of "B" Bile? *Arch. Int. Med.*, 1929, XLVIII, 147.
 - (35) LEVINE, SAMUEL: Contractions of Gall Bladder Seen in Man. *Arch. Int. Med.*, 1927, XL, 420.
 - (36) MANN, F. C.: The Functions of the Gall Bladder; An Experimental Study. *New Orleans Med. and Surg. Jour.*, August, 1918, LXXI, 80.
 - (37) McCANN, JAMES C.: Studies on the Emptying of the Stomach. *Am. Jour. Physiol.*, 1929, LXXXIX, 497.
 - (38) MANN, F. C., and HIGGINS, GEORGE M.: Effect of Pregnancy on the Emptying of the Gall Bladder. *Arch. Surg.*, 1927, XV, 552. Also *Proc. Soc. Exper. Biol. and Med.*, June, 1927, XXIV, 930.
 - (39) MORRIS, HENRY: Human Anatomy, 1898.
 - (40) McMASTER, PHILIP D., and ELMAN, ROBERT: On the Expulsion of Bile by the Gall Bladder, and a Reciprocal Relationship with the Sphincter Activity. *Jour. Exper. Med.*, August 1, 1926, XLIV, 173.
 - (41) MURPHY, GEORGE T.: The Effect of Acute Experimental Cholecystitis on the Emptying of the Gall Bladder. *Arch. Surg.*, August, 1930, XXI, 310.
 - (42) MACCALLUM, W. G.: A Text-book of Pathology, 1916.
 - (43) MOYNIHAN, SIR BERKELEY: Addresses on Surgical Subjects, 1928.
 - (44) MAXIMOW, BLOOM: Text-book of Histology, 1930.
 - (45) NEWCOMER, N. B., NEWCOMER, ELIZABETH, and CONYERS, C. A.: Conclusions Based upon the Routine Intravenous Administration of

- Sodium Tetraiodophenolphthalein in Gall-bladder Diagnosis. *RADIOLOGY*, July, 1928, XI, 56.
- (46) OCHSNER, A. J.: *Clinical Surgery*, 1905.
 - (47) OSLER, SIR WILLIAM: *The Principles and Practice of Medicine*, 1930.
 - (48) POPE, CHARLES E.: The Effect of Gastro-intestinal Operations on the Emptying of the Gall Bladder. *Am. Jour. Med. Sci.*, July, 1929, CLXXVIII, 48-54.
 - (49) REHFUSS, MARTIN E.: The Diagnosis and Treatment of Diseases of the Stomach, 1927, p. 52.
 - (50) ROUS, PEYTON, and MCMASTER, PHILIP D.: The Concentrating Activity of the Gall Bladder. *Jour. Exper. Med.*, 1921, XXXIV, 47.
 - (51) ROGERS, F. T., and MARTIN, C. L.: X-ray Observations of Hunger Contractions in Man. *Am. Jour. Physiol.*, 1926, LXXVI, 353.
 - (52) ROYSTER, HUBERT A.: Gall-bladder Diseases. *Med. Jour. and Rec.*, September 3, 1930, p. 232.
 - (53) STARLING, ERNEST H.: *Human Physiology*, 1930.
 - (54) SCOTT, W. J., and WHITAKER, LESTER R.: Expulsion of its Contents as a Function of the Gall Bladder. *Proc. Soc. Exper. Biol. and Med.*, 1928, XXV, 421.
 - (55) TODD, T. WINGATE (England), and KUENZEL, WILHELMINE (Cleveland): Studies in the Alimentary Tract of Man. *Jour. Lab. and Clin. Med.*, October, 1929, XV, 43.
 - (56) TEMPLETON, R. D., and JOHNSON, V.: Further Observations on the Nature of Hunger Contractions in Man. *Am. Jour. Physiol.*, 1929, LXXXVIII, 173.
 - (57) WHITAKER, L. R., and BOYDEN, E. A.: Observations on the Function of the Gall Bladder. *Am. Jour. Physiol.*, 1926, LXXVI, 199.
 - (58) WINKELSTEIN, A., and ASCHNER, P. W.: The Mechanism of the Flow of Bile from the Liver into the Intestines. *Am. Jour. Med. Sci.*, 1926, CLXXI, 104.
 - (59) WHITAKER, L. R., and EMERSON, W. C.: Emptying of the Gall Bladder in Pregnancy. *Am. Jour. Physiol.*, 1928, LXXXIV, 516.
 - (60) WILSON, M. J., DICKSON, W. E., and SINGLETON, A. C.: Rate of Evacuation of Various Foods from the Normal Stomach. *Arch. Int. Med.*, 1929, XLIV, 787.
 - (61) WHITAKER, LESTER R.: The Mechanism of the Gall Bladder. *Am. Jour. Physiol.*, 1926, LXXXVIII, 411.

DISCUSSION

DR. THOMAS A. GROOVER (Washington, D. C.): I am sure we will all agree with the essayists that the gall bladder is a more or less movable sac which is subject to changes in shape and position by extrinsic pressure, including, of course, pressure from the stomach and duodenum. I am not so sure that all of us would be willing to accept, offhand at least, the interesting hypothesis advanced to the effect that the gall bladder is emptied by

the thrust of the stomach and duodenum against it. I think that some arguments could be advanced to the contrary. First, I am sure that all of us have observed, in the course of routine cholecystographic examinations, with the subject fasting, that at one time we would find the gall bladder large, then we would find it small, and then we would find it large again, which, of course, would argue against the mechanical factor as causing it to empty. The fact of the matter is that such a phenomenon as this is one that we rather like to see, because it probably has some diagnostic significance. I believe it is highly probable that if we made examinations at frequent intervals, we would observe it much more frequently than we do. In the second place, I do not believe that any one has ever been able to empty the gall bladder by external pressure or by manual manipulation. Third, it requires considerable pressure to empty a filled gall bladder when you have the belly opened and can grasp it in your fingers. Fourth, it is a well known fact that the taking of certain foods, particularly fats, will cause a rapid emptying of the gall bladder, whereas other foods, whether liquid or solid, have comparatively little effect. Fifth, I should think that it would be necessary to disprove the work of Ivy and Oldberg before accepting the mechanical factor. I wish to pay tribute to the novelty of the idea suggested by the essayists, that the mechanical factor plays such an important rôle in solving a much disputed question. Of course it may prove to be correct. I feel sure that there are many modifications of function and also much disease due to simple mechanical causes that we fail to recognize and appreciate. I have enjoyed the paper presented, as it opens up a new field for thought and investigation as to the explanation of gall-bladder emptying.

DR. L. T. LEWALD (New York): I wish to call attention to the theory of Dr. Sweet, who has written several papers on the formation of gallstones, stating that the gall-bladder secretion and bile in it is entirely removed by absorption. I have heard him make the statement that what goes into the gall bladder

through the cystic duct never comes out through the cystic duct. I would like very much to know if the writers have paid any attention to these observations, which seem very far-fetched to me. I would also like to ask if they have had an opportunity to study some cases of partial gastrectomy and see what happens in those cases in which there is no pressure possible from the stomach or duodenum.

DR. A. C. SIEFERT (Oakland, Calif.): I have frequently seen the gall bladder filled with the contrast medium as long as forty-eight hours after injection or ingestion of tetraiodophenolphthalein, the patient taking fluid liberally but no solid food and, especially, no food containing fats. The stomach must have been well distended by copious intakes of fluid. Again, I have never seen the gall bladder empty when giving a meal or rather a drink of barium water, even in amounts sufficient to distend the stomach and the duodenal cap well. I, therefore, cannot accept the theory that has been set forth by the speaker.

A MEMBER: I had the privilege of working with the writer a short time in 1925, and some of the things that Dr. LeWald has suggested we did. We, after considerable search, found a patient who had had a gastrectomy, in whose case all the food left the stomach by the gastrotomy. In that individual the gall bladder emptied after a food that was rich in fat.

DR. NEWCOMER (closing): I realize that the idea seems rather novel. I wish to answer Dr. LeWald first. I have read carefully the articles by Sweet in which he claims that bile which has entered the gall bladder is absorbed into the circulation and does not pass through the cystic duct into the duodenum. Since the visualization of the gall bladder, Sweet's idea has been discarded by all, even Sweet himself. Vigorous peristalsis of an empty stomach,

even, will partially empty the gall bladder. In those cases of gastrectomy which I have seen, the gall bladder does not empty completely in the normal time. Imperfect emptying of the gall bladder can occur by interchange of bile due to secretory pressure. If I am right in the theory that normal emptying of the gall bladder is caused by the pressure of a filled stomach in active peristalsis, what happens when a gall bladder is filled with stones or does not fill at all? If nothing enters the gall bladder, the secretory pressure of the liver overcomes the sphincter of Oddi and the bile enters the duodenum as it is secreted. If the gall bladder fills and is not in proper contact with the antrum and cap, it may empty imperfectly for a time at least by the intermingling and dilution of freshly secreted bile. This is not the normal method, however.

In regard to the question as to why water in the stomach does not empty the gall bladder, I would say water passes through the empty stomach without producing peristalsis. The extent of peristalsis depends on solid food; that is why I emphasize solid food so much. On the slides, I showed you how much more the gall bladder was displaced by solid food in the stomach than by a liquid meal. It is well known that solid food stimulates vigorous peristalsis. After an intravenous dye test, you can give water indiscriminately with the stomach empty, without emptying the gall bladder. We allow patients whatever water they want; it goes right through without peristalsis. In regard to giving solid foods, to produce emptying of the gall bladder, we have been using the intravenous dye test for years, followed by a solid meal. The method of using cream and egg did not appeal to us—it is not a normal meal. We started in by giving solid food and we have found that the normal gall bladder empties after a normal meal of solid food. We always take a twenty-four-hour film, to determine if the gall bladder is entirely empty at this time.

RADIOGRAPHY WITH GREAT ENLARGEMENT (MICRORADIOGRAPHY) AND A TECHNICAL METHOD FOR THE RADIOGRAPHIC DISSOCIATION OF THE SHADOW

By PROF. ALESSANDRO VALLEBONA

From the Radiologic and Electrotherapeutic Institute of the Royal Institute of Genoa, Italy,
Prof. V. Maragliano, Director

Translation by E. T. LEDDY, M.D., Rochester, Minn.

I HAVE named "microradiografia," or "technic of radiography with great enlargement," that procedure which I have proposed by which to obtain radiographic images enlarged directly, a procedure which I described in 1928 and to which I have called attention in several publications and worked out under the guidance of my chief, Prof. V. Maragliano.

It is to be noted that many attempts have been made to enlarge ordinary roentgenograms by optical means (Piergrossi, Moreau), but this type of enlargement, because of the character of the image and the structure of the sensitive film, can not be carried beyond a certain point. There are also some commercial optical methods for enlarging the image on the fluorescent screen.

Attempts have also been made to produce rapid enlargements by moving the fluorescent screen to a greater distance (Krause and Kreuzfuchs) or by moving the photographic plate (Grödel and Wachter).

It is known that if we move the object away from the plate and bring it nearer to the source of radiation, we get an enlarged image which will be a sharp one if the rays emerge from a point, but practically, the focal spot of the X-ray tube is far from being a point, and is, in fact, an area of some size. So by moving the object away from the screen or plate we obtain, it is true, an enlarged image but a blurred one, due to the optical effect of penumbra.

If, however, we place between the object which we desire to enlarge and the target of the tube a very small window, the rays coming from the target will cross as a result of

this, and, following their rectilinear path to the photographic plate, will reproduce faithfully, enlarged on the image of the target, any object which is between the window and the sensitive plate.

This is the principle which I propose to apply in order to obtain directly enlarged images in radiography.

The apparatus for producing the enlargement is extremely simple. It is sufficient to arrange a series of lead disks with small holes in them, varying in size from 1 or 2 millimeters to 1 or $\frac{1}{2}$ decimillimeter. These lead disks are screwed into the window of an autoprotecting tube.

The technic consists in placing the object, an enlarged image of which is desired, more or less distant from the film according to the degree of enlargement desired; the greater the distance between the object and the plate the greater will be the enlargement resulting, but the diameter of the window will be smaller. By this method we obtain directly an enlarged image with roentgen rays.

I have shown in previous papers the differences between photographic enlargement of an ordinary roentgenogram and that obtained directly, especially since the roentgenogram obtained in this way can also be enlarged by optical means.

The procedure I am discussing here permits one to obtain enlarged roentgenograms directly; permits one, even when the purpose is not to obtain enlargement, to produce roentgenograms with good detail, a fact which is of much importance in studying those regions of the body which are of necessity distant from the photographic

plate and which with ordinary technics would not give a sharp image.

I have shown evidence of the importance this technic may have in the study of the structure of bone; I have called attention to the usefulness this technic may have in studying pulmonary structure and in craniology, but, laying aside all this, I wish now to present some considerations of a modification of this technic as applied to the study of the head.

It is well known that the radiographic image which results is the summation in the same plane of all the shadows arising in the various planes of the body traversed by the roentgen rays.

In craniology, and especially in the study of the base of the skull, the numerous shadows which are superimposed one on another produce an intricate network of lines which make the interpretation of the roentgenogram difficult in certain cases.

As a result of this, it would be most advantageous to have an image, so to speak, distinct from that of all the various planes and without the image of them being superimposed on that one of interest to us. In other words, it would be an advantage to do with X-rays what we do with the microscope; that is, to focus only one plane of the object.

If we could adopt with roentgen rays lenses and reflectors as we can with light rays, or if we could put only one plane in focus as with the microscope, the problem would be very simple; but since it is impossible to do this at present, it is necessary to try some other way.

Let us imagine that the photographic plate and the roentgen tube are united in a rigid system, capable of rotation around an axis, and which, while radiography is carried on, has a slight movement on its own axis. Any object which is in the axis of movement will produce a good image, while the others will be softened and blurred in the roentgenogram. We can imagine that in

the roentgenographic examination of the head, it can be made to slightly rotate on an axis which corresponds to the region which is of interest in the examination.

For many reasons I have followed this latter path and have constructed two types of apparatus, which, during an examination, cause rotation of the head on an axis which passes through the plane of the region under consideration. If we use this simple technic we will find another way to sharpen the roentgenogram.

As I have pointed out in the first part of this communication, the focus of the target is never a point but is always a surface, as a result of which the image of a plane of the cranium which is at a certain distance from the plate will never be sufficiently sharp.

Now let us go back to the technic of enlargement which permits us to obtain sharp images, even of regions which are distant from the plate. It is sufficient to use, instead of an ordinary X-ray tube in the apparatus for producing rotation, an autoprotecting tube, in the window of which there is screwed a disk with a little hole in it, which, in the case in point, should be of a diameter sufficient to give a sharp image but not an enlarged one, as the case may be, of 1 or 2 millimeters, which will permit us to shorten the time of exposure.

At the last Italian Congress of Radiology in Turin, I showed radiographs in which the various strata of the head were, so to speak, isolated.

With this technic we can explore almost separately the various levels of the base of the skull, and avoid—up to a certain point, at least—the superimposition of extraneous shadows.

These two procedures should be studied further and perfected, for there is no doubt but that they can render useful service in advancing the improvement of radiographic technic.

CASE REPORTS AND NEW DEVICES

PASSIVE CONGESTION OF THE LUNGS IN THE PRESENCE OF CORONARY SCLEROSIS

By JOHN FRYE CHAPMAN, M.D.

PASADENA, CALIFORNIA

The following two cases are presented because of their striking radiographic appearance and their similarity in clinical history, findings, and outcome, and because the knowledge of the cause of the first led to the correct diagnosis of the second. The third case is presented because of the similar appearance though the outcome was recovery.

Case 1. The patient, A. H. L., a male, aged 50 years, complained of continuous

severe precordial pain, two weeks in duration between date of onset and death.

Present Illness.—On the morning of November 15, 1928, he began to have acute severe pain in the right upper quadrant of the abdomen. By noon the pain had shifted to the precordium, left shoulder and arm. This pain continued and required opiates from time to time for relief. Three days later he became quite intensely jaundiced and remained so for a week, after which the jaundice disappeared.

Past History.—No previous serious illnesses. An attack of acute indigestion two years before had been readily cured by diet and rest.

Physical Examination.—Large-framed,

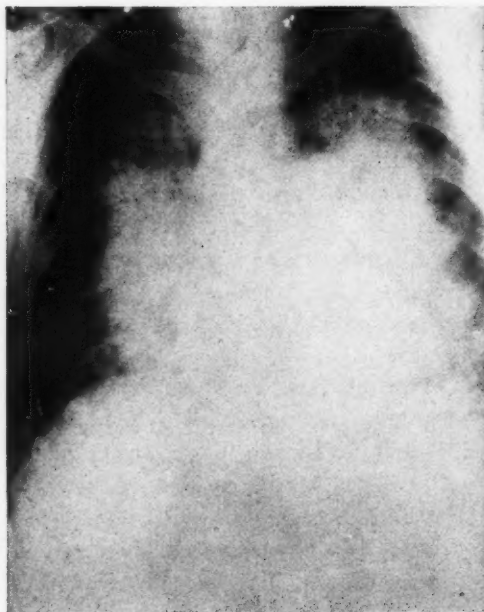


Fig. 1. Case 1.



Fig. 2. Case 2.

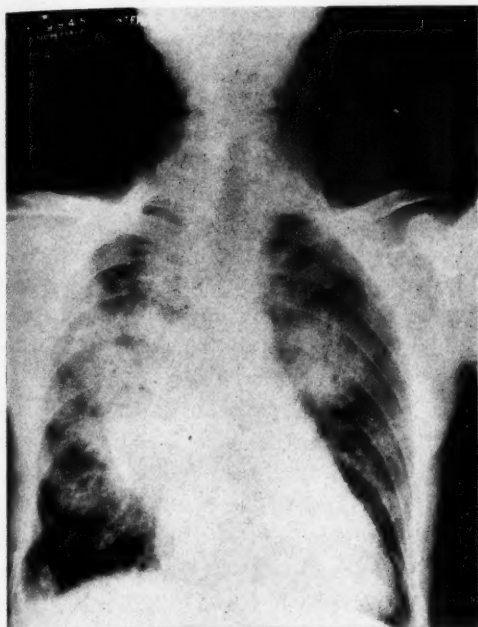


Fig. 3. Case 3.

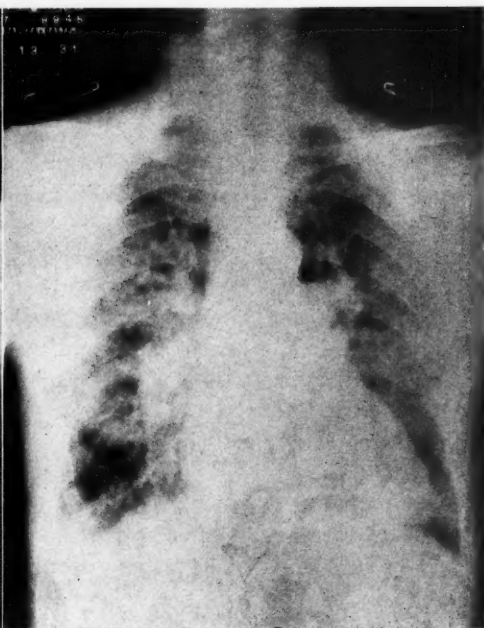


Fig. 4. Case 3, showing condition when patient was much improved over that shown in Figure 3.

big-chested man, anxious expression, slight exophthalmos, dyspnea, very slight cyanosis. The heart was considerably enlarged to palpation and percussion; friction rub felt at apex. Moist râles throughout the chest. Cough produced some bloody sputum. Abdominal tenderness in right upper quadrant and epigastrium.

Outcome.—Symptoms continued unabated. The patient developed pulmonary edema and died fifteen days after onset of illness.

Autopsy.—The left upper lobe of the lung was edematous. The outer third of the lower lobe was congested, red, and contained no air. The vessels throughout the lung were extremely congested and the pulmonary veins were engorged. Bronchi were filled with fluid, but not injected, or red. Lower lobe and part of the middle and upper lobes on the right were dark red in

color. Blood flowed readily from cut surface. Marked engorgement of pulmonary veins and branches. Small infarcts in the outer surface of the right lower lobe. Pericardial sac contained no fluid but pericardial adhesions were present throughout. Heart twice normal size. On outer aspect of left ventricle is a triangular area of necrotic muscle with a rupture, the rupture being sealed by adherent pericardium. Heart was dilated, its walls thin, its valves all negative. Right coronary artery sclerotic, but patent. The left coronary artery entered the soft necrotic muscle of the left ventricle, but no thrombus could be demonstrated.

In going over the findings with Dr. Sturdivant, the pathologist, and trying to correlate them with the radiographs, he stated that the shadows seen on the radiographs were undoubtedly due to engorgement of the large pulmonary vessels—that

there was not enough congestion of the lung parenchyma to cause them. The films were taken about five days after the onset of the illness and much congestion of the lungs may have taken place afterward.

Case 2. The patient, W. S. D., male, aged 69 years, complained of precordial pain and shortness of breath.

Present Illness.—Two weeks before examination he was putting up a water drain at the eaves of his home (an unusual exertion for him), when he fell from the ladder, but seemingly without serious injury. A short time after this he began to have a severe heavy pain in the middle of the chest, which radiated first to the right shoulder and then shifted to the left shoulder and down the left arm. The left arm felt weak, numb, and was very painful. There was also pain in the epigastrium, which became a prominent symptom. Dyspnea and orthopnea were constant and extreme.

Past History.—He had had the usual diseases of childhood, no rheumatic fever, no syphilis. Eight years previously he had had empyema on the right side.

Physical Examination.—Head negative. Neck, pulsating carotids. Chest, numerous coarse râles at both bases, more marked anteriorly. Impaired resonance at both bases anteriorly and posteriorly. Heart, no precordial thrills. Moderate enlargement of left ventricle. Weak systolic murmur at both aortic and mitral areas: arrhythmia. Abdomen negative, except for enlarged and slightly tender liver. Otherwise physical findings were not remarkable. Electrocardiogram showed myocarditis, with insufficiency.

The patient died one week after entering the hospital and at autopsy the findings of importance were as noted below.

Autopsy (Pleural cavities).—The left contained about a liter of clear straw-colored fluid; the right showed marked adhesions,

particularly at the base. (*Lungs*): The pulmonary veins were considerably distended. Thorough sectioning revealed no tumor in either lung and the parenchyma showed very little congestion. The right lung showed no evidence of old abscess though it was markedly adherent to the diaphragm and there were a few small bronchiectases. In general, however, the lungs were in quite good condition. *Heart* weighed 560 grams, very much enlarged: all valves negative. There was a large thin plaque of fibrinous mural thrombus one inch in diameter over the inside of the left ventricle near the tip and the myocardium here was friable. Elsewhere in all parts of the myocardium of the left ventricle there was very marked degeneration and fibrosis. The wall was not hypertrophied, being only about one centimeter in thickness. Both coronary arteries showed marked sclerosis in all branches, but especially in the descending branch of the left coronary. There was practically complete occlusion of this branch at a point 3 or 4 cm. from its origin, but there were no coronary thrombi. There were no other findings in the chest.

An attempt to correlate the autopsy findings with the radiographs leads to the conclusion that the shadows extending out from the lung roots were undoubtedly due to the engorged large pulmonary vessels, the lung parenchyma having been found very little congested.

Case 3. The patient, B. T., male, aged 68 years, complained of (1) pain in left side of abdomen radiating downward from left lumbar region, paroxysmal in character, duration one week; (2) vomiting.

Past History.—Attacks of a similar nature have been fairly common in the past. He has known for a long time that he has serious heart disease; in fact, in previous attacks he has nearly lost his life, but rest

and treatment have always resulted in fairly prompt recovery.

Physical Examination.—Well developed but not very well nourished man of 68 years. Head and neck not remarkable, except that there is slight cyanosis. (*Chest*): Coarse moist râles throughout both lungs. (*Heart*): Enlargement on percussion not noted in findings. Pulse irregular in rate and quality. Blood pressure 152/80. No murmurs noted. (*Abdomen*): Liver edge at costal margin. Ileac vessels palpable through abdominal wall. Question of nodular mass in left hypochondrium. (*Extremities*): Marked sclerosis of peripheral arteries.

X-ray Examination.—Colon negative for evidence of obstruction. Abdomen negative for radiographic evidence of gallstones or urinary calculi. (*Chest*): Shadows extending out into both lung fields very suggestive of congestion in large vessels secondary to coronary sclerosis and advanced myocarditis. Enlargement of heart.

Sputum.—Scanty fresh blood-tinged, chiefly mucus, with a few leukocytes and endothelial cells and Gram-positive diplococci and streptococci. No tubercle bacilli.

Feces.—Negative. (*Urine*): specific gravity, 1.016. Trace of albumin. Many hyaline and granular casts, some leukocytes.

Blood Count.—Red blood corpuscles, 4,370,000; white blood corpuscles, 14,500; polymorphonuclears, 82 per cent; lymphocytes (large), 6 per cent; lymphocytes (small), 12 per cent; no abnormal cells; hemoglobin, 83 per cent.

Admitted February 23, 1931; dismissed March 14, 1931; much improved.

The similarity of appearance of the radiographs in this case and the previous ones is striking. I particularly wish to call attention to the heavy centrally placed shadows, the comparatively clear periphery of the lungs, and especially the clear lung bases, which in the usual passive congestion of de-

compensation in heart disease one would expect to find clouded. Figure 4 is of Case 3, just before the patient left the hospital and when he was feeling much improved. One notices that the central shadows are still visible, though less extensive, less dense, and more clear-cut. The three cases present an unusual type of passive congestion, and one which I believe always indicates the presence of severe coronary disease and left ventricle degeneration.

TUBERCULOSIS OF THE URETER, WITH TWO CASE REPORTS

By LLOYD BRYAN, M.D., and
JOSEPH LEVITIN, M.D.

SAN FRANCISCO

From Department of Roentgenology, Mt. Zion
Hospital

Involvement of the ureter is a frequent complication of tuberculosis of the kidneys, the bacilli being carried down by the urine.



Fig. 1. Case 1. Film made in March, 1926. Shortening and stiffening of the right ureter. Left ureter normal.



Fig. 2. Case 1. Film made in January, 1929. Shortening and stiffening of both ureters. Multiple calcified shadows in both kidneys.

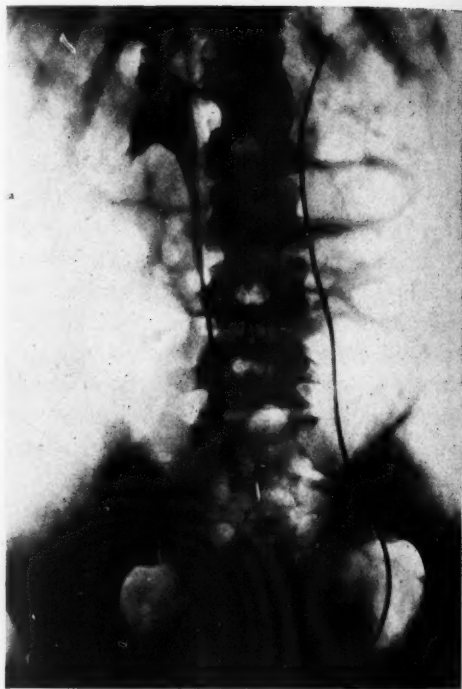


Fig. 3. Case 2. Straightening and shortening of the right ureter.

Ulceration or caseous infiltration follows, resulting in a shortened, thick-walled, firm, widened ureter, with a ragged ulcerative lining. This shortening with stiffening can be seen on a roentgenogram by means of opaque catheters.

This was first observed by Dourmashkin, who found it in 84.6 per cent of his series of 13 cases of unilateral tuberculosis. This may be the first X-ray evidence of tuberculosis of the kidney, as was observed in the following two cases:

Case 1. K. S., female, aged 36 years, seen in January, 1929. For the past five years she had had dull pain under the right ribs. Five years ago, in March, 1926, she had severe pain on the right side, radiating to the back, with chills, vomiting, and hematuria. The urine was loaded with pus. Cystoscopic examination showed a congest-

ed bladder mucosa. Catheterization of the ureters showed pus coming down from both sides. A diagnosis of pyelitis was made. X-ray examination with catheters in place showed shortening and stiffening of the right ureter; however, this was not recognized at the time as being associated with tuberculosis.

At the next entry, in January, 1929, with the same complaints, cystoscopic examination showed ulceration and congestion of the bladder wall. X-ray films showed multiple calcified shadows in both kidneys, with shortening and stiffening of both ureters.

Guinea-pig inoculation was positive for tuberculosis on both sides.

Case 2. R. B., female, aged 22 years. Had upper abdominal pain, worse in left hypochondrium and flank for the past sev-

eral months. Nocturia, and burning pain upon urination.

Cystoscopy showed hyperemic, ulcerative bladder mucosa.

Pyelograms showed normal kidney pelvis on both sides. The right ureter, however, was straight and shortened.

Guinea-pig inoculation from the right side was positive for tuberculosis.

Upon removal of the kidney, the specimen was of twice normal size, the cortex destroyed by cystic degeneration, and filled with purulent material. A smear of this pus showed numerous tubercle bacilli. There was no involvement of the kidney pelvis.

CONCLUSIONS

Tuberculous involvement of the ureter is a frequent complication of tuberculosis of the kidney.

It may be present before involvement of the kidney pelvis can be demonstrated.

A diagnostic sign is straightening and shortening of the involved ureter, which can be determined by use of an opaque catheter.

REFERENCE

DOORMASHKIN, RALPH L.: A Roentgen-ray Sign in the Diagnosis of Unilateral Renal Tuberculosis. *Jour. Urol.*, April, 1929, XXI, 455-464.

A CASE OF ADHESIONS OF THE SMALL BOWEL

By ARTHUR R. BLOOM, M.D.,
and
LOUIS J. GARIEPY, M.D.

DETROIT, MICHIGAN

Lesions of the small bowel are rarely suspected and, as a result, are seldom looked for. The following case is of interest in this respect.

S. W., a little girl six years of age, had been complaining of pain in the abdomen, associated with nausea, for six months prior to this examination. On two occasions she

vomited. For about ten days before we saw the patient, the pain had been getting worse although at no time was it sharp. Recently she had been awakened at about 3 A.M. with pain, relieved by pressure over the abdomen.

The child had had scarlatina and varicella in infancy. She had a perverted appetite, eating glass, chalk, paper and such things.

One of us (L. J. G.) was called to see the child on the morning following one of her nocturnal attacks. The parents thought that she had appendicitis, but the surgeon found that the abdomen was soft and that there was no tenderness and no elevation of temperature and, therefore, he did not think she had appendicitis but that she might have a partial obstruction resulting from the various foreign substances she ate. After several more attacks an X-ray study was ordered, for the purpose of ruling out the presence of foreign bodies in the gastrointestinal tract.

On February 5, 1931, a roentgen-ray study of the gastro-intestinal tract was started by one of us (A. R. B.). A preliminary film of the abdomen showed no evidence of opaque foreign bodies. The chest was normal. The stomach and duodenum were also normal as to size, shape, motility, and mobility.

At one hour there was 80 per cent of the barium mixture in the stomach, the remainder being scattered throughout the small bowel. A loop of bowel was located at about the middle of the abdomen, towards the left side, which was dilated. There was a marked to-and-fro movement. This appearance was also noted at later examinations at two, three, and four hours. At three and a half hours the stomach was empty. At twenty-four hours the colon was completely filled, with no barium in the small bowel. The appendix was filled, fairly mobile, and tender, the tenderness being located directly over the appendix and chang-

ing with its position. At forty-eight hours the cecum was empty but the appendix was still filled, and tender. An opaque enema revealed a normal contour of the colon. There was no evidence of foreign bodies.

pendix, which appeared chronically inflamed, was removed. Convalescence was uneventful and three months later the child was still free from symptoms.

Macroscopic examination of the appendix

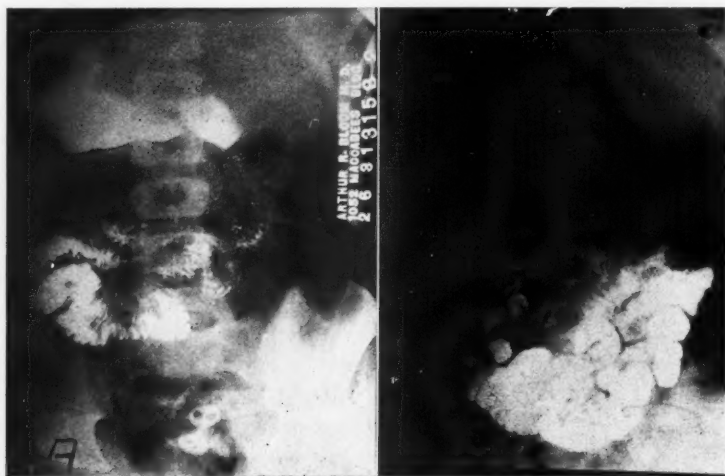


Fig. 1-A. Film made one hour after the barium meal. Note the dilated loop of small bowel in the lower left quadrant.

Fig. 1-B. Film of the same case made four hours after the barium meal. The dilated loop of bowel is still to be seen.

Roentgen Diagnosis.—Adhesions around a loop of small bowel causing a partial obstruction, and a pathologic appendix.

On February 8, the patient was admitted to the hospital. The physical examination failed to reveal any findings. No abnormal abdominal movements were noted on inspection. The urine was normal and the blood count showed 11,000 white blood corpuscles.

Operation by one of us (L. J. G.) revealed a loop of small bowel which was partially obstructed and dilated, due to adhesions. It was discolored, resembling in appearance an old bruise. The adhesions were divided and normal peristalsis passed through this segment of the ileum; the ap-

pendix showed marked fecal retention. *Microscopic diagnosis:* Chronic catarrhal appendicitis, Grade 2, with fecal retention and pressure atrophy.

COMMENT

Here was a case which might have been diagnosed as subacute appendicitis, the appendix removed, and nothing further done. At operation, one would have been justified if he looked no farther. The same is true of the roentgen study. In these cases it is of importance to observe these patients hourly, paying particular attention to the appearance, motility, and position of the small bowel.

EDITORIAL

LEON J. MENVILLE, M.D. . . . Editor

*Contents of RADIOLOGY copyrighted by the
Radiological Society of North America.*

STANDARDIZATION OF HOSPITAL X-RAY EQUIPMENT

The Radiological Society of North America has realized for some time the need for standardizing hospital X-ray equipment. The first constructive evidence of its interest in this regard was manifested at the last annual meeting of the American Hospital Association, which was held in New Orleans, October, 1930. At this meeting the Radiological Society presented by invitation an educational exhibit, consisting of a fully equipped X-ray department, representing the type of X-ray apparatus found in a modern hospital of moderate size. This demonstration was perhaps the first of its kind ever presented before such a large body of hospital authorities.

Many inquiries were made concerning the nature and purpose of this exhibit, by superintendents of private, municipal, state and government hospitals, and also from officials of the United States Public Health Service. They were mainly interested in knowing whether the Radiological Society could furnish specific information in regard to the type of necessary X-ray equipment for hospitals of different sizes. It was mentioned by them that authoritative information pertaining to hospital X-ray equipment was not available, and that because of the practical application of such knowledge and also the responsibility involved in purchas-

ing such apparatus, they believed it should be the duty of some recognized body of radiologists to sponsor an investigation. They were of the opinion that such an investigation should obtain accurate knowledge relative to equipping hospitals with suitable X-ray apparatus, and that this information should be disseminated among the hospital authorities and the medical profession of this country.

The Radiological Society assumed this responsibility when it presented its exhibit at the meeting of the American Hospital Association. It, therefore, behooves this Society to institute a survey which will ascertain the type of equipment used in the different X-ray departments of the various hospitals in this country. In this manner, first-hand information would be procured in compiling valuable statistics for a study to standardize hospital X-ray equipment, and incidentally to acquire other valuable data of interest to the radiological and medical profession.

Such an investigation would serve to verify a current opinion that the purchase of X-ray equipment for a hospital is often made upon the recommendation of high pressure salesmanship, often without proper regard to the requirements and needs of the institution. It would not be surprising, therefore, to find that some of the hospitals have X-ray equipments in excess of their needs, and others are inadequately furnished. For instance, it is not considered necessary for a 15-bed hospital to have a super-deep X-ray apparatus, because the demand for its use in such a small hospital would be negligible. There can be no objection to such a hospital owning this apparatus, but if its purchase was made on the recommendation that it was an indispensable piece of equipment for a hospital of that

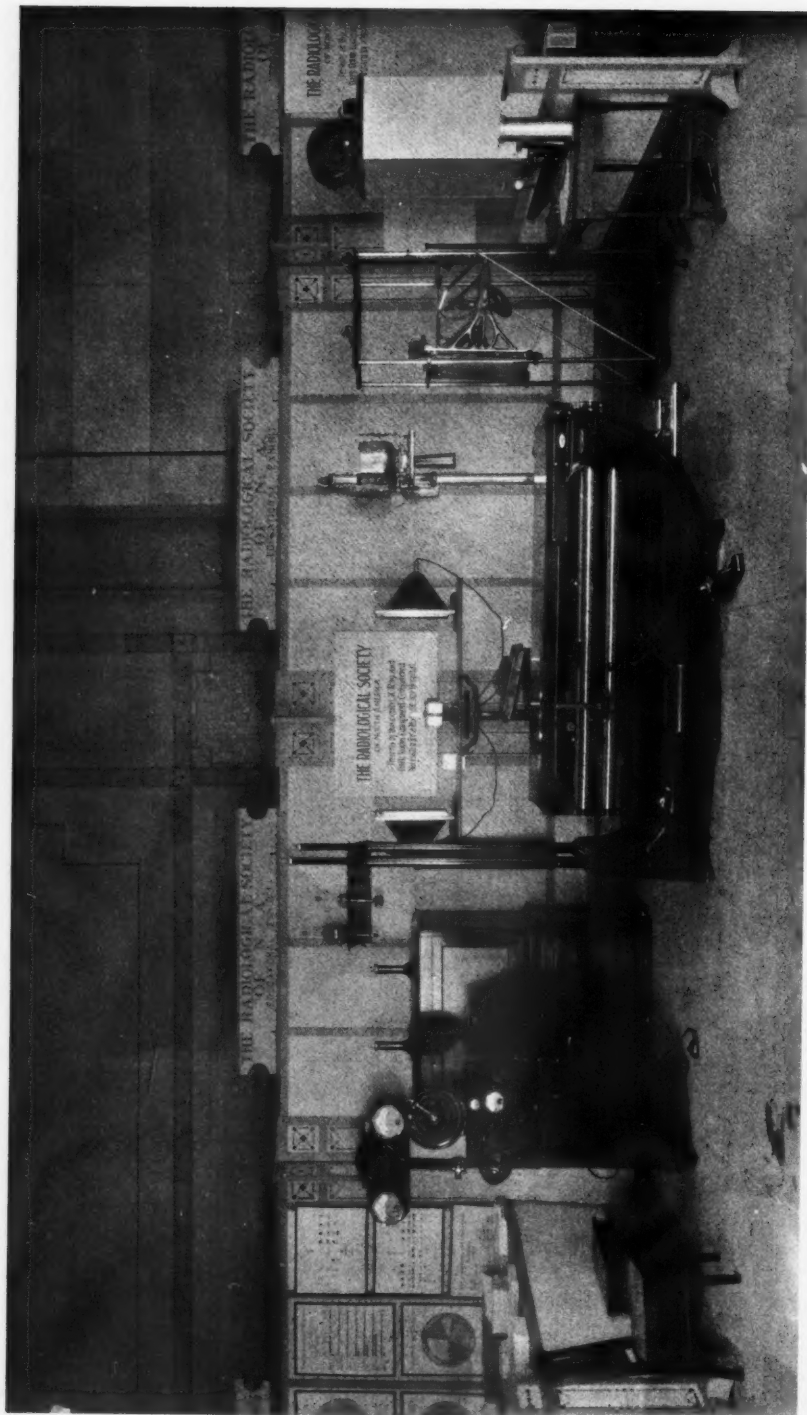


Fig. 1. An educational exhibit, demonstrating a fully equipped X-ray department for a hospital of moderate size, presented by invitation at the New Orleans (1930) meeting of the American Hospital Association, by the Radiological Society of North America. See Figure 2 for further description. The success of this exhibit was the result of the co-operation of Dr. Robert J. May, then President of the Society, and Dr. I. S. Trosler, Secretary and Treasurer, and the valuable assistance of one of our prominent X-ray manufacturers, who generously loaned the apparatus without any display of advertising matter.

size, then an injustice has probably been done the institution.

Incidentally, the investigation may reveal that some hospitals are equipped with only a portable machine or its equivalent, and some have no X-ray apparatus at all. It would be interesting to know, in an instance wherein a hospital was equipped with only a portable machine, whether its staff was acquainted with the prevailing situation, and also if the X-ray reports were considered accurate.

The ultimate result of such an extensive investigation would be of momentous importance in its practical application to the standardization of hospital X-ray equipment, and would be a sure indication of an earnest desire on the part of the Radiological Society of North America to actively co-operate in any enterprise in which organized medicine is interested.

DR. M. J. HUBENY, AS WE KNOW HIM¹

The resignation of Dr. M. J. Hubeny as editor of *RADIOLOGY* has come as a real loss to the members of the Radiological Society.

As members of the Publication Committee we have been brought into close contact with Dr. Hubeny for many years, and this journalistic association is one we shall sever with the feeling of deep regret.

It is easy now, when the success of our Journal is assured, to forget the years of unremitting toil which have been given to it, or the many vicissitudes through which it has passed. Some of us will recollect the time when we were faced with such difficult problems that it seemed as if we might not be able even to survive. The Journal was faced with litigation, and we had no funds

with which we might fight for our rights; we were without the proper records, and were quite in the dark as to how we might best carry on, so that it might be edited with experience; and, further, we had still a reputation to make ere we could command the respect, attention, and support of the radiological field.

To find someone who was able and willing to take over this stupendous task, and build us up a new Journal, under such handicaps, was no light undertaking, and it was a very fortunate, opportune, and wise selection that saw in Dr. Hubeny the man we needed. We may well congratulate ourselves that in the days of such difficulty we had found one who was willing to give of himself so generously, in time, in energy, and in money, that he might succeed in the task to which he had set himself.

Such a condition might well strain the reputation of the best of men, as it needed not only editorial ability, but great skill in handling this most difficult situation. But in spite of these trying circumstances Dr. Hubeny was persuaded to accept the post, and henceforth he made it his own work, with such results as we all know. It is due to his untiring efforts and singular ability that we have a Journal to-day of which we may well feel proud.

In the beginning he was immediately faced with the most strained situations, and only by his own grace and acceptability were they overcome, winning over to us many who later have given us much good service. Along with the officers he shouldered our legal troubles, and, at more cost in time and money than we shall ever know, never rested until he had freed us from the stigma of litigation, and the Society had won the right to publish its own Journal.

But most of all may we appreciate his work as editor-in-chief of *RADIOLOGY*. In splendid anonymity he has remained in the background and we see only the fine contributions from many illustrious sources. It

¹Received for publication June 17, 1931.



Fig. 2. This exhibit was divided into three sections: (1) the office of the roentgenologist, containing, besides the usual office furniture, a filing cabinet for films and an X-ray illuminator upon which was displayed many interesting films obtained from New Orleans hospitals; (2) the developing room, equipped with electric dryer, time clock, and other appliances used in developing X-ray films; (3) the examining and treatment room, containing apparatus modern in design and efficiently arranged. On the walls were displayed numerous interesting placards, furnished by Dr. I. S. Trostler, explaining the dangers to which patients expose themselves when being examined or treated roentgenologically by non-medical men.

has taken years of the most patient work to win us the regard in which we now stand. Of the drudgery of that work, of the great persistence it required, especially during those early years, we know nothing. The results are apparent to us all, and we may well take this opportunity of congratulating Dr. Hubeny on the success of his editorship of the Journal as we see it to-day. For it is to his unselfish devotion alone that we owe its success. We acknowledge our debt to him, and realize that in losing him we lose an editor of outstanding ability and a guide whose hand we shall miss.

To have been associated with Dr. Hubeny is to have felt an ever-increasing respect for him. We see in him a man who has committed himself with fortitude to the high purposes of this life, and has accepted the challenge offered to all of us. As he goes forward with single aim to accomplish his life work he will carry with him our esteem and regard, and the best wishes of his fellow-members of our Society.

Publication Committee,

DR. W. H. MCGUFFIN, *Chairman,*

DR. R. H. STEVENS,

DR. R. J. MAY.

ANNOUNCEMENTS

SECTION ON RADIOLOGY OF AMERICAN MEDICAL ASSOCIATION

The Section on Radiology at the Philadelphia meeting held three morning sessions: Two sessions were devoted to diagnostic radiology, the third to radiotherapy.

At the therapy session, Dr. Sosman, of Boston, spoke on xanthomatosis in bone, describing both the diagnosis and the treatment with X-ray, which is empirical, but results in certain beneficial effects.

Dr. J. Thompson Stevens, of Montclair, N. J., read a paper giving his results in a large series of cases of hyperthyroidism.

Dr. G. E. Pfahler, of Philadelphia, spoke on the treatment of cancer of the lip. He mainly uses electrocoagulation or radium on the primary lesion and gives very intensive doses of radium or high voltage therapy over the surrounding area and the regional lymphatics. Dr. Pfahler showed many brilliant results which he has secured by this treatment.

Dr. Howard A. Kelly, of Baltimore, read a paper on the radiation treatment of menstrual disorders. Dr. Kelly stressed the necessity of complete and accurate diagnosis before such treatment is given. In dysmenorrhea in young girls the prospect is not very encouraging. In excessive bleeding around the menopause, either from small fibroids, or in cases in which no gross disease is demonstrable, the results are excellent. Dr. Kelly's paper and Dr. C. C. Norris' discussion were listened to with much interest.

Dr. Isaac Levin, of New York, gave his results in cancer of the breast treated with a combination of surgery and radiotherapy.

Dr. Ira I. Kaplan, of New York, reported his method of treating advanced cases of cancer of the rectum at the Bellevue Hospital. One gathered that Dr. Kaplan preferred contact applications of radium without colostomy or other surgical operation for this type of case.

The Chairman's address, while not delivered at this session, was on a therapeutic subject, "Accuracy in Roentgen-ray Dosage." Dr. Erskine stressed the importance of accurate measuring devices for both superficial and deep roentgen-ray treatment.

The diagnostic papers began with one by Dr. A. B. Moore, of Washington, D. C., on the roentgen diagnosis of chronic appendicitis. The point on which Dr. Moore laid particular emphasis was the value of fixation as a sign and the technic of the various

fluoroscopic procedures necessary to elicit this sign.

Dr. Maurice Dwyer, of Seattle, Washington, read a paper on the results of cholecystectomy, which, incidentally, included a comparison of the roentgen diagnosis with the operative findings. It also included a complete follow-up on cases operated on, with a tabulation of results as regards relief from the symptoms of which the patient had complained pre-operatively. In his series about 50 per cent of the patients had complete relief from operation.

Dr. John L. Kantor, of New York, spoke on anomalies of the duodenum and colon and their relation to normal function. The demonstration was exhaustive and included all types of malformation, from those having only anatomical significance to those which demand immediate relief by radical measures.

Gastric polyposis was dealt with by Dr. B. R. Kirklin, of the Mayo Clinic. He showed examples of all the various types, from the small single polyp to the very extensive general polyposis, stressing the point that malignant degeneration may occur in these polyps.

The relation of accessory nasal sinus infection to lung symptoms was discussed by Dr. John D. Osmond, of Cleveland, Ohio. He pointed out the frequency with which pulmonary tuberculosis is suspected or diagnosed when the actual pathology is in the nasal sinuses.

Dr. Ernest A. Kraft, of Chicago, read a paper on melorheostosis (Leri), an unusual type of abnormal bone proliferation. He reviewed the literature and reported two cases of his own which demonstrated very well this rare bone disease.

Dr. Samuel Brown, of Cincinnati, Ohio, gave a very interesting discussion on pathologic conditions of the diaphragm. He presented what he believes to be a new sign of subdiaphragmatic abscess, namely, an up-

ward displacement of the posterior part of the diaphragm, shown, of course, only in the lateral view.

Dr. John T. Farrell, Jr., of Philadelphia, presented a very complete study of the chest in cases which had been operated on for lung abscess. A thorough follow-up in cases of this sort is not often available and a study of the material presented by Dr. Farrell will be very helpful.

Dr. E. C. Vogt, of Boston, presented an original research in the X-ray study of the bones of children suffering from lead poisoning. Dr. Vogt showed many films demonstrating a deposit of metallic lead near the ends of the long bones in this disease. He also showed the disappearance of this dense line in the bones as the children recovered from the disease. Study of the bones in children who have died from the disease proves that the characteristic dense line shown on the X-ray film is actually due to lead and not to some alteration in the normal mineral salts of the bone. Dr. Vogt warns against confusing this line of opacity with the similar change seen in healed rickets.

Dr. I. S. Trostler, of Chicago, read a very timely paper stressing the importance of making X-ray reports comprehensive, accurate, and intelligible to the referring physician.

Dr. Robert B. Taft, of Charleston, S. C., presented a paper on roentgen diagnosis of mastoiditis, mostly in children. He discussed the difficulties of making satisfactory examinations in young patients and demonstrated his own technic for this purpose.

All the sessions were well attended and the program appeared to hold the attention of those present. The success of this meeting must be a source of great satisfaction to those of our confrères who worked so hard to establish this Section on Radiology.

G. W. GRIER, M.D., *Secretary.*

PENNSYLVANIA RADIOLOGICAL SOCIETY

The Sixteenth Annual Meeting of the Pennsylvania Radiological Society was held in McKeesport, May 13 and 14, 1931, with an excellent program given by essayists representative of the radiologists of the State. The guest speakers were J. L. Weatherwax, M.A., and Charles Robb, of Philadelphia, and J. A. Bargen, M.D., of Rochester, Minnesota.

The officers of the Pennsylvania Radiological Society are: A. R. Snedden, M.D., of McKeesport, *President*; J. J. Singer, M.D., of Greensburg, *First Vice-president*; W. J. Sterrett, M.D., of Pittsburgh, *Second Vice-president*; W. E. Reiley, M.D., of Clearfield, *Secretary-Treasurer*; G. D. Bliss, M.D., of Altoona, *Editor*. The Radiological Society of North America is proud to say that all of these physicians are among its members.

THE ST. LOUIS MEETING

RAILROAD INFORMATION

The passenger associations throughout the United States and Canada have authorized a rate of one and one-half fare for the round trip to the St. Louis meeting of the Radiological Society of North America for the benefit of members of the Society and dependent members of their families, who will attend the Annual Meeting next Winter.

In order to have the benefit of a return rate of one-half fare, it will be necessary for each member to secure a Certificate from the railroad ticket agent when purchasing a ticket to St. Louis. The Certificate must be deposited with your Secretary at the registration desk upon arrival at the meeting. After 150 of these Certificates have been

deposited they will be signed by your Secretary and validated by the representative of the railroad company, after which they may be reclaimed by their owners and will be honored for one-half the return trip fare.

If the ticket agent at the member's home city does not have Certificates, each member should secure a receipt or information where such Certificate can be obtained. It would be well for all members expecting to attend the St. Louis meeting to see their railroad agents soon and ask that they secure Certificates in advance.

While the railroads are granting these greatly reduced rates for many meetings and conventions, the statistics of railroads show that the number of occasions attracting a number of 150 or more persons by rail is gradually decreasing. We have represented to the railroads that reduced rates are essential to the success of our meeting, and the railroads are glad, of course, to cooperate in an effort to make it so, but in many cases the small number of tickets sold by the railroads would seem to indicate that members individually are little concerned as to whether or not the reduced railroad rates are available, since they are more and more using other means of transportation in travelling to and from the places of meeting. This, of course, works to the disadvantage of their fellow-members, particularly where arrangements have been authorized on the Certificate plan and the special rate on the return trip is dependent upon the presentation of 150 or more Certificates. It has frequently happened that a hundred or a hundred and twenty-five have travelled by rail, paying full fare on the going trip with the expectation of securing one-half fare returning, while the remainder of those attending the meeting have used automobiles or buses and thus made it impossible for those who actually travelled by rail to secure any reduction. Fortunately, this has never occurred in connection with our meetings

but I am making this communication so that it may not occur at St. Louis.

Therefore, as the carriers have complied with our request and have authorized these special rates for those attending the meeting of the Radiological Society at St. Louis I sincerely trust that all members will travel by rail so that the railroad ticket sale and registration of Certificates will be sufficient to permit of the return trip at one-half fare.

I. S. TROSTLER, M.D.

THE AMERICAN COLLEGE OF PHYSICIANS

The American College of Physicians will hold its Sixteenth Annual Clinical Session at San Francisco, with headquarters at the Palace Hotel, April 4-8, 1932. Following the Clinical Session, a large percentage of those attending will proceed to Los Angeles, where a program principally of entertainment will be furnished April 9, 10, and 11.

Announcement of the dates is made particularly with a view not only of apprising physicians generally of the meeting, but also to prevent conflicting dates with other societies that are now arranging their 1932 meetings.

Dr. S. Marx White, of Minneapolis, is President of the American College of Physicians, and will arrange the Program of General Sessions. Dr. William J. Kerr, Professor of Medicine at the University of California Medical School, San Francisco, is General Chairman of local arrangements, and will be in charge of the Program of Clinics. Dr. Francis M. Pottenger, of Monrovia, is President-elect of the College, and will be in charge of the arrangements at Los Angeles. Mr. E. R. Loveland, Executive Secretary, 133-135 S. 36th Street, Philadelphia, Pa., is in charge of general and business arrangements, and may be addressed concerning any feature of the forthcoming Session.

REPRINTS OF CASE REPORTS

We are happy to announce that, through the generosity of the Chemical Foundation, RADIOLOGY is able to furnish 100 reprints (without covers or envelopes) to authors of Case Reports, upon request. In the past this service was of necessity reserved to the authors of papers of fuller length.

We hope our readers will interpret this as a desire on the part of RADIOLOGY to cooperate with them to the fullest extent in the building up of an extensive Case Report Department.

H. P. DOUB, M.D.

Associate Editor for Case Reports.

IN MEMORIAM

JOHN ROBERT KELLEY

1871-1931

John Robert Kelley, a well known and highly respected pioneer in the manufacture of roentgen apparatus, passed away on April 23, 1931, in his sixtieth year.

He was born in Thessalia, Virginia, where, as a boy, he experimented in telegraphy and learned to send and receive Morse code. He also worked for a few years as a commercial telegrapher. He entered commercial life, yet studied and experimented in electricity, because he had become deeply interested in the discovery of Roentgen. In fact, he used all his means and spare time in X-ray experiments.

In 1902 he moved to Covington, Kentucky, where for months he sought to interest men in financing a factory for the manufacture of X-ray apparatus. Shortly after meeting Albert B. Koett, a partnership was formed and a factory started in a small shed-like structure. The business prospered so that the firm soon moved to larger quarters and again enlarged, after a short interval, until finally the factory of the Kelley-

Koett Manufacturing Company was built and occupied.

It is the writer's belief that this firm's interest in radiology did much to foster and advance the knowledge of apparatus in the early days when little was known of the possibilities, characteristics, and dangers of the machinery of the then young science. Much of the apparatus used in the field hospitals of the U. S. Medical Corps during the World War was designed by "Bob" Kelley and produced by his firm.

He was an enthusiastic motorist and advocate of good roads, at the time of his death being President of the Northern Kentucky Motor Club. Although not a politician, his services were much in demand by political and governmental bodies. Governor F. D. Sampson appointed him to the Kentucky State Progress Commission and his associates in this body immediately elected him Vice-chairman. He had recently been elected Chairman of the Executive Committee of the Summit Hills Country Club. He was also an enthusiastic aviator, having made numerous more or less extended flights. In local affairs his keen foresight and broad knowledge were much sought after, with the result that at various times he occupied numerous public positions of responsibility and prominence. He had been honored in the various Masonic bodies.

Hon. F. D. Sampson, Governor of Kentucky, in a proclamation closing the State offices for the funeral, said in part: "Col. Kelley, as Vice-chairman of the Kentucky Progress Commission, has rendered a significant, public-spirited service to Kentucky, devoting almost his entire time at a sacrifice of business and the calls of other civic organizations to a whole-hearted, unselfish effort to promote the welfare, advancement, and prosperity of his beloved State.

"Receiving and seeking no remuneration, spending unstintedly of his means and energy, jeopardizing his very life in a

patriotic cause that his keen vision saw must be vigorously prosecuted and sustained to raise the status of his State to the proper place in the Nation, Col. Kelley has rendered an invaluable service to the Commonwealth of Kentucky and to his fellow-citizens." Other tributes of similar type were rendered by Charles Eugene Clark, a prominent Covington attorney, and the newspapers of Covington (Kentucky) and Cincinnati (Ohio), showing the high regard in which he was held.

Although "Bob" knew that he had an inoperable gastric carcinoma, his morale was such that he was not heard to complain, and as recently as the last meeting of the Radiological Society in Los Angeles, last December, he was actively interested in the meeting and joined his many friends in the events of that occasion. He had been present at every meeting of this Society and accompanied all the pilgrimages and tours except the last California train.

He was a reliable business associate, a good citizen, a cheerful, agreeable companion and friend, and in every way a fine gentleman.

I. S. TROSTLER, M.D.

BOOK REVIEWS

PRACTICAL X-RAY TREATMENT. By ARTHUR W. ERSKINE, M.D., Cedar Rapids, Iowa. Pages 116, with numerous charts and illustrations. Bruce Publishing Company, Saint Paul, Minnesota, 1931. Price \$3.50.

This book, which the author says is not written for expert roentgenologists, takes up in a practical way the use of three routine technics (two at 135 and one at 200 kilovolts) in roentgenotherapy. The author has set down his personal opinions, has avoided controversy about methods, and has,

throughout the whole book, emphasized accuracy in treatment so that both underdosage and overdosage may be avoided.

The main body of the book (the first 66 pages) takes up—in order—current, apparatus and protection, measuring instruments, factors affecting skin dosage, factors affecting the depth dose percentage, and standard technics from a non-mathematical, descriptive, physical point of view. There, then, follows a chapter on the skin dose (pages 67 to 74), on the effects of roentgen rays on tissues (pages 75 to 80), on skin diseases (pages 81 to 91), on non-malignant conditions (pages 93 to 100), and finally one on the roentgen-ray treatment of malignant conditions (pages 101 to 112).

The presentation of the physical side of the "moderate voltage" technics merits special commendation because most other texts on roentgenotherapy have glossed over this very important subject.

The make-up of the book leaves nothing to be desired and is in perfect accordance with the publisher's high standard.

It is hoped that in future editions more space will be allotted to a discussion on the quality of roentgen rays and that some notes on valve rectifiers and autoprotecting tubes will be included. From the clinical point of view it seems that the treatment of lymphoblastoma should be emphasized more, that the chapters on cancer of the uterus and on sarcoma should be enlarged, that something about tumors of the testis should be included, and that the whole section on treatment of cancer should be expanded to about twice its present length.

This book will appeal to the student who is already familiar with the fundamentals of roentgen therapy but who is not quite ready to delve into the complexities of the mathematical and physical aspects of treatment, and to anyone seeking practical, useful information that will enable him to do good treatment work away from a large institution with its wealth of facilities.

TECNICA RADIODIAGNOSTICA. By PROF. M. PONZIO, Director of the Maurizian Radiological Institute of Torino, Turin, Italy. A volume of the Collection of Medical Manuals, published by the Unione Tipografica, Turin, Italy, August, 1930. With 350 figures in the text and 96 half-tone illustrations.

This concise book of nearly five hundred pages covers the ground of roentgen physics and diagnosis. The General Section of 158 pages discusses the nature of the X-ray; various types of generating apparatus and tubes; methods of measuring X-rays; accessory instruments, including the latest compressor diaphragm; an adequate discussion of the Bucky diaphragm, with a description of Potter's work to perfect and utilize Bucky's idea, and many other data relative to the technical side of X-ray work. The author offers an excellent scheme of classification for a radiographic library. The second part of the book, comprising the remainder of 438 pages, is devoted to a discussion of clinical radiological diagnosis, which is notable for its completeness, considering the small compass of the work. The illustrations are excellent, especially those which are included in the tables printed on special paper as inserts. The final chapter is devoted to the localization of foreign bodies.

JAMES T. CASE, M.D.

MALADIES DE L' APPAREIL RESPIRATOIRE. Pathologie médicale, tome III. Collection de Précis Médicale. Written by FERNAND BEZANCON, MARCEL LABBE, LEON BERNARD, J. A. SICARD, A. CLERC, P. EMILE WEIL, A. PHILIBERT, S.-I. DEJONG, A. SEZARY, PASTEUR VALLERY-RADOT, TH. ALAJOUANINE, CH. FOIX, G. VITRY, M. BLOCH, JEAN PARAF, ANDRÉ BLOCH, J. THIERS. Second Edition, 1931. Masson and Company, Paris. Pages 747, many illustrations and 36 roentgenographic plates. Price 70 francs.

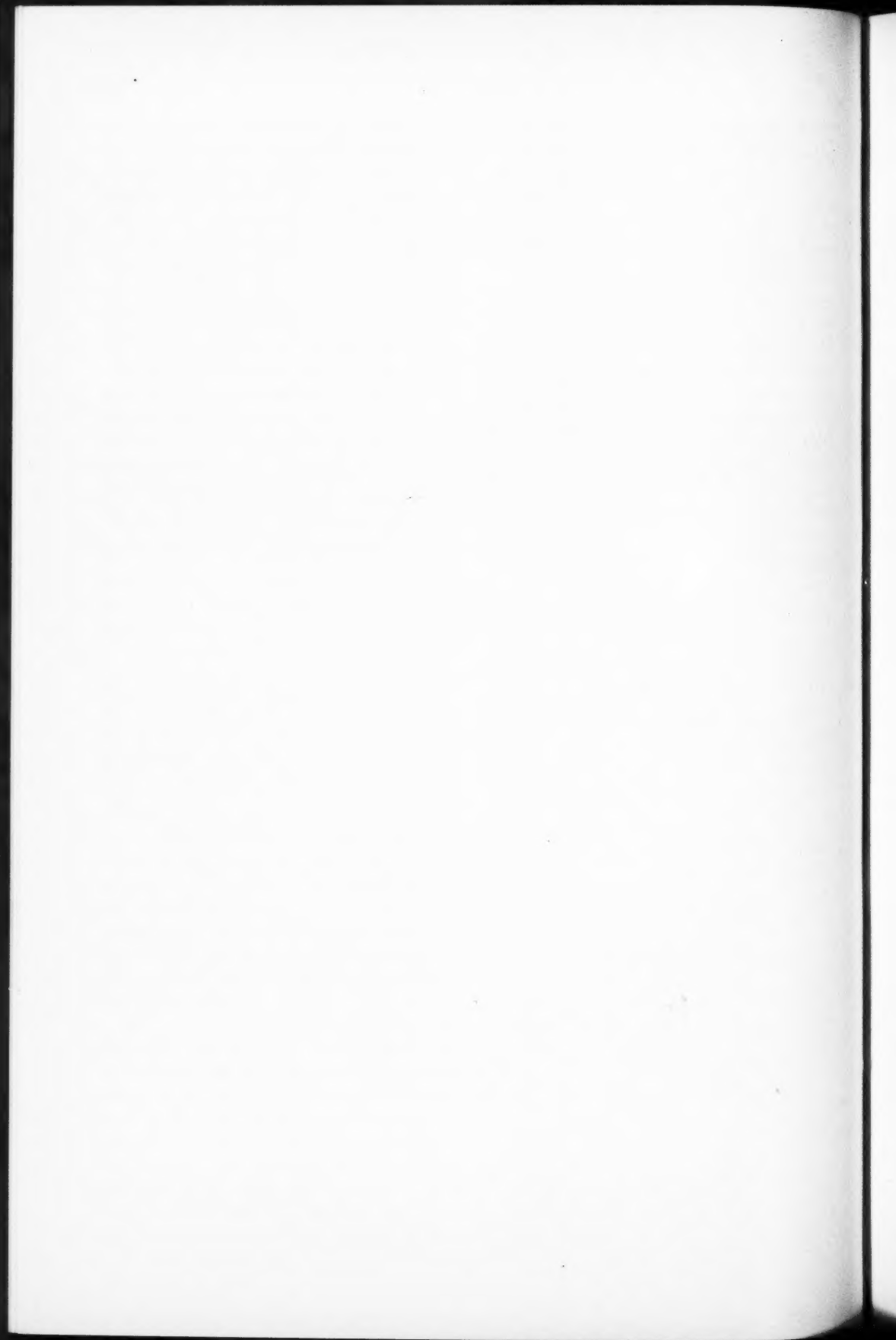
This compact book is the third volume of a series of short treatises on different phases of medical pathology designed to give to the student and practising physician a summary of the latest ideas on diseases of the respiratory apparatus. The size, typography, character of illustrations, and general bookmanship are in keeping with the purpose of the work. An excellent index is provided. The clinical and pathologic descriptions of the different varieties of respiratory diseases are excellent. Unlike many other even more important text-books, of which a common fault heretofore has been to neglect the radiologic aspects of the diseases treated and to overlook the diagnostic and therapeutic assistance which radiology has been shown to furnish in many such diseases, this work incorporates such information in a satisfac-

tory manner. Especial attention is given to the infectious and other inflammatory diseases. The discussion of asthma in general is adequate. The only important defect is that so little space is given to description and discussion of intrathoracic tumors. For instance, carcinoma of the lung is dealt with in sixteen pages interpolated between the two parts of the book dealing with the acute and chronic respiratory diseases, respectively, and only a little over one page is devoted to mediastinal tumors. Therefore, it may be said that while the authors have done ample justice to the acute and chronic respiratory inflammations, the injustice done to intrathoracic tumors in general constitutes a glaring defect. In every other respect, however, the work is to be commended.

A CORRECTION

The paper entitled "The Story of the First Roentgen Evidence," by Sanford Withers, M.D., of Denver, Colorado, was read before the Radiological Society of

North America at the Sixteenth Annual Meeting, at Los Angeles, Dec. 1-5, 1930. A footnote to this effect was inadvertently omitted when the paper was published in *RADIOLOGY*, July, 1931, XVII, 99.



ABSTRACTS OF CURRENT LITERATURE

CONTENTS BY SUBJECT

Abdomen	362	Genito-urinary Tract (Therapy).....	391
Appendix (Diagnosis)	363	Gynecology and Obstetrics.....	392
Bladder	364	Heart and Vascular System (Diagnosis).....	393
Blood Changes	365	Hodgkin's Disease	397
Bone (Diagnosis)	365	Kidney	398
Bone (Therapy)	368	Mastoid	401
Bone Diseases (Diagnosis).....	369	Measurement of Radiation.....	401
Cancer (Diagnosis)	372	Medical Practice	402
Cancer (Therapy)	374	Radiation Sickness	403
Cathode Rays	377	Radium	404
Chest (Diagnosis)	377	Roentgenotherapy	408
Contrast Media	380	Skin (General)	412
Dosage	380	Surgery	412
Experimental Studies	381	Thymus (Diagnosis)	413
Foot	381	Tuberculosis (Diagnosis).....	415
Gall Bladder (Normal and Pathological).....	382	Tuberculosis (Therapy).....	418
Gastro-intestinal Tract (Diagnosis).....	384	Tumors (Diagnosis)	418
Gastro-intestinal Tract (Therapy).....	388	Tumors (Therapy)	419
Genito-urinary Tract (Diagnosis).....	389	Ulcer (Etiology)	420

THE FOLLOWING ABSTRACTORS HAVE CONTRIBUTED TO THIS ISSUE

J. N. ANÉ, M.D.
 CHARLES S. CAPP, M.D.
 L. J. CARTER, M.D.
 JOHN R. CARTY, M.D.
 D. S. CHILDS, M.D.
 C. H. DeWITT, M.D.
 HOWARD P. DOUB, M.D.
 J. E. HABBE, M.D.
 A. O. HAMPTON, M.D.
 ALAN L. HART, M.D.
 H. W. HEFKE, M.D.
 H. A. JARRE, M.D.
 E. T. LEDDY, M.D.

WALTER M. LEVITT, M.B., M.R.C.P., D.M.R.E.
 WALLACE D. MACKENZIE, M.D.
 ROE J. MAIER, M.D.
 F. B. MANDEVILLE, M.D.
 H. C. OCHSNER, M.D.
 DAVIS H. PARDOLL, M.D.
 ERNST A. POHLE, M.D., Ph.D.
 H. RUDISILL, Jr., M.D.
 J. G. STEPHENS, M.D.
 CHARLES G. SUTHERLAND, M.D.
 H. J. ULLMANN, M.D.
 W. W. WATKINS, M.D.
 CHARLES WROTH, M.B., D.M.R.E.

ABDOMEN

Ossification in a Laparotomy Wound. Philip G. Silver. *Can. Med. Assn. Jour.*, March, 1931, XXIV, 414.

This is a case report of a development of true bone in an abdominal wound, following cholecystectomy.

Ten days following the operation, the patient felt soreness in the upper end of the abdominal wound. Three weeks later a small pocket of pus was found in the upper end of the abdominal incision, and was evacuated. Shortly afterward, induration began to be noticed in the wound. This became steadily more pronounced until the scar became as hard as bone. Radiographs were taken six weeks and two months after the operation, but there was no evidence of calcification on either occasion. Three months after the operation, the first sign of calcification was seen on a radiographic film. On account of pain and resulting disability, the calcified area was removed and found to be a piece of bone 12 cm. in length and 4 cm. in width. It apparently had originated in the aponeurosis and not in the rectus muscle itself.

The author discusses the various theories as to the genesis of myositis ossificans. Practically all of these theories are elaborations of one or the other of the two opposing basic theories, the "periosteal" theory and the theory of "true metaplasia." The periosteal theory assumes that the newly formed bone in the muscle arises from the periosteum of a neighboring bone. The theory of true metaplasia assumes that connective tissue cells present in the fibrous tissue septa of muscles may, under certain conditions, develop into true bone-forming cells.

In the case of bone forming in laparotomy wounds, the periosteal theory is hardly applicable, and one is obliged to consider other factors. The view generally accepted is as follows: The lineæ transversæ, representing the remains of the extension forward of the ribs, and the white line representing the prolongation downward of the sternum, may sometimes contain osteogenic elements. These elements,

lying dormant there, are stimulated by injury to proliferate, and new bone is formed.

L. J. CARTER, M.D.

A Case of Pyloric Stenosis Due to Pancreatic Cysts. E. Furrer. *Schweiz. med. Wchnschr.*, Feb. 14, 1931, LXI, 162.

This is a case report of a patient who, for two years, had pain in the upper abdomen often accompanied by vomiting, especially after the morning meal. A roentgen examination demonstrated a large filling defect in the region of the pylorus; this was interpreted as a carcinoma. On operation, a large thick-walled cyst of the head of the pancreas was was disclosed.

H. C. OCHSNER, M.D.

A Contribution to the Diagnosis *in Vivo* of the *Situs Inversus* of the Abdominal Organs: Report of Three Cases. A. Determann. *Röntgenpraxis*, March 15, 1931, III, 261.

Three cases of partial *situs inversus* of the abdominal organs are described. The chest organs were in normal position. Although it is possible to make a definite statement as to the position of the stomach, duodenum, gall bladder, and colon by roentgenographic means, the position of the liver and spleen cannot be made with certainty in all cases.

H. W. HEFKE, M.D.

Acute Pyopneumothorax: A Case in an Infant Aged Nine Weeks. Julian L. Rogatz and Albert Rosenberg. *Am. Jour. Dis. Child.*, May, 1931, XLI, 1104-1110.

After a careful review of the literature, the authors found only one case, in addition to their own, of acquired acute pyopneumothorax, proven by autopsy observations, in infants under three months of age.

A bedside roentgenogram showed pneumothorax of the left side, with vertical and horizontal bands, which suggested the appearance of a diaphragmatic hernia. The heart and mediastinum were slightly displaced to the right. Twenty-four hours later, following a

barium meal, a roentgenogram showed the pneumothorax to be increased in size. A Y-shaped shadow noted was found, at autopsy, to have been due to adhesions. The barium was seen in the stomach below the diaphragm, thus ruling out the possibility of diaphragmatic hernia. The etiology was attributed to furunculosis, the onset of which was noted at the age of four weeks.

F. B. MANDEVILLE, M.D.

The Importance of Roentgenographic Examinations in Acute Cases of Circumscribed or Diffuse Peritonitis. Anders Westerborn. Surg., Gynec. and Obst., April, 1931, LII, 804-814.

In order that the patient may not be subjected to a long procedure, the abdomen and thorax are fluoroscoped and films made without the aid of a barium enema; however, if necessary, one is given. The patient is placed in the supine position and the diaphragm is studied for mobility. He may be turned from side to side, in order to bring out suggestive areas in the abdomen. Inflammatory processes in the abdomen give the appearance of increased gas and fluid content, with diminished motility of the intestine. Fluid level may be determined, and large homogeneous shadows may be surrounded by gas-filled intestinal coils.

With the barium enema, an abscess may show an impression on, or compression of, the intestinal lumen, which may have an even or a jagged outline, diminished motility of the diaphragmatic leaf, or exudate in the phrenicocostal sinus. In some cases, the disappearance of the shadow of the psoas is noted.

Case histories and reproductions of roentgenograms illustrative of these points accompany the paper.

D. S. CHILDS, M.D.

APPENDIX (DIAGNOSIS)

The Radiological Diagnosis of Chronic Appendicitis. Paul Jacquet and Léon Gally. La Presse Méd., March 14, 1931, XXXIX, 376-379.

The authors have found the radiological diagnosis of chronic appendicitis to be accurate and reliable. The technic employed by them

depends upon the examination of the terminal ileum and cecum six hours after the ingestion of a meal containing 200 gm. of barium.

Localization of the Site of Tenderness.—Often tenderness ascribed clinically to the appendix is found to be due to pelvic cellulitis, neuralgia of the visceral plexus, pelvic adenopathy, and, most frequently, pain referred to the abdominal wall from some viscus, such as the bladder. The tenderness elicited by pressure must coincide with the internal border of the cecum, as revealed on the screen, and follow it in all positions before it can be ascribed to the appendix.

Delay at the Ileocecal Junction.—In the normal subject the barium fills the ascending colon to the hepatic flexure in six hours, only a small residue being visible in the ileum. If the appendix is affected, there is a residue in the ileum, at least equal to that already in the colon, and the ileum is hypertonic, the barium being massed in isolated loops. Delay at the ileocecal junction of twenty-four hours or more has been found to be only rarely associated with chronic appendicitis, and is more often due to organic stenosis, caused by cancer of the ileocecal region, tuberculosis of the cecum, or adhesions.

Ileocecal Spasms.—These have not been encountered, except in cases of appendicitis. Sometimes they take the form of general contraction of the cecum and ascending colon, and occasionally are localized. They may be visible without palpation, but often may be evoked by pressure on the site of tenderness, and their presence may be demonstrated on the film by the maintenance of a moderate degree of compression, by means of a small air cushion. A contraction in the cecum is often seen on the lateral border, opposite the tender point, and is analogous to the incisura opposite a gastric or a duodenal ulcer. The ileal spasms are essentially localized and transitory.

Visualization of the Appendix.—The appendix is rarely visualized at six hours, and can more often be seen filled at twelve or twenty-four hours, when the cecum is on the point of emptying. Valuable confirmation is obtained if the appendix and the site of tenderness are found to coincide, but this is not indispensable.

Pyloric Irregularity.—The stomach often

empties irregularly, although appearing to empty rapidly; at six hours a residue is still to be seen in it, while at other times, although at first inactive, it is found to have evacuated the meal in one or two hours. Generally, when there is abnormal behavior both at the pylorus and the ileocecal junction, the authors have found the appendix to be at fault.

CHARLES WROTH, M.B., D.M.R.E.

BLADDER

Bladder Diverticula and Their Surgical Removal. J. S. Eisenstaedt. *United States Vet. Bureau Med. Bull.*, April, 1931, VII, 313.

The author believes that increased intracystic pressure, due to obstruction or infection or both, is an important factor in the formation of diverticula, in congenitally weakened regions of the bladder wall. The most frequent site of the occurrence of these herniations is in the vicinity of the ureteral orifices. The size may vary from a cavity containing a few c.c. to one containing several liters.

In the series of cases reported by the author, microscopic examination of the walls of the diverticula revealed that all layers of the bladder wall were represented. In the presence of prolonged infection the walls were found to be markedly thickened. However, as a result of stretching, some of the cases showed thinning of the walls with flattening of the lining epithelium.

Infection of a diverticulum frequently occurs, and, because of the location of the cavity and its narrow contracted orifice, it is almost impossible to overcome the invading organisms. Other associated conditions are calculi, or tumors, found within the diverticulum.

Vesical diverticula are usually symptomless unless infected. No characteristic symptoms are observed and they appear as various disturbances of urination, depending on associated pathology. The diagnosis is made by cystoscopy and cystography. A series of cystograms affords the best method of accurate diagnosis, especially in those cases in which cystoscopy is impossible or difficult. In some cases it is found possible to coil a shadowgraph catheter in the cavity. Subse-

quent roentgenographic studies give valuable information regarding the size and location of the diverticulum. Intravenous urography, likewise, should be especially valuable in examining cases in which instrumentation is dangerous. Roentgen-ray exposures should be made in supine, lateral, and semi-lateral positions. Stereoscopic films are also valuable aids.

The treatment of diverticula of the bladder is complete surgical removal unless the general condition of the patient prohibits operative interference.

J. N. ANÉ, M.D.

Bladder Tumor: Survey of Fifty Cases. R. F. Mathews. *Am. Jour. Surg.*, February, 1931, XI, 343-353. (Reprinted by permission from *British Med. Jour.*, May 9, 1931, No. 3,670, p. 86 of *Epitome of Current Medical Literature.*)

The author defines three groups of bladder tumors: (1) growths, either papillomatous or pedunculated, which project well into the bladder; (2) sessile growths which spread laterally along the bladder mucosa and project less into the bladder, and (3) infiltrating growths, which invade every layer of the bladder and of the surrounding bladder tissue. Bladder tumors are either benign, the papilloma being the most common of this type, or malignant, such as malignant papilloma, papillary carcinoma, adenocarcinoma, and epithelioma. The benign papilloma is always intravesical and begins as a tiny excrescence on the surface of the epithelium. Later on this frequently becomes malignant, with thickening of the epithelial layers, multiplication of the layers, and fusion of the papillae. Bladder tumors are most common in the region of the trigone and ureteral orifices, and occur in males and females in the proportion of 4 to 1. Secondary effects of bladder tumors are bleeding, obstruction in the ureter or urethra, necrosis, ulceration, encrustation, stone formation, infiltration of the bladder wall, and infection.

Painless hematuria is usually the first and only symptom, occurring in 90 per cent of cases. It is generally intermittent, and cys-

toscopy should be undertaken at a time when the bleeding has stopped in order that the tumor may more easily be identified. Treatment depends on the nature and location of the tumor. Excision or resection does not relieve the condition, and in some cases aggravates the symptoms, there being superadded implantations and metastasis.

Radium in the form of radon seeds, used in conjunction with other methods of treatment, has proved satisfactory. High frequency current through the cystoscope, or by suprapubic operation, has worked well in apparently hopeless cases, and for benign growths fulguration with the bipolar high frequency current is the treatment of choice. Deep X-ray therapy can be used successfully as an adjuvant to other types of treatment, and relieves pain.

The mortality rate for all types of carcinomatous tumors of the bladder was 75 per cent; in cases of malignant papilloma it was 12 per cent, and in cases of benign papilloma there were no deaths.

BLOOD CHANGES

Blood Sugar Changes after Irradiation of the Suprarenal Regions. Cherigie, Langeron, and Desplats. *La Presse Méd.*, April 11, 1931, XXXIX, 526.

The blood sugar level is lowered by irradiation of the suprarenals, both in normal persons and in diabetics, but in the latter the reduction is very much greater. Four doses of 1,000 R (Solomon) were given to each suprarenal region, and the fall in blood sugar commenced soon after the application of the first dose.

WALTER M. LEVITT, M.B., M.R.C.P., D.M.R.E.

Blood Studies in Cases Receiving Protracted Fractional X-ray Treatment. Walther Gloor and Adolf Zuppinger. *Strahlentherapie*, 1931, XL, 438-464.

In eleven cases of malignant tumors, blood examinations were carried out regularly while the patient received X-ray therapy, according to the protracted fractional method (Coutard). The red blood picture showed variations dur-

ing the treatment, but recovered quickly after the last exposure. The qualitative changes were very small. The variations in the leukocyte count differed depending upon the presence of mucous membranes, with squamous epithelium in the irradiated area. As a rule, there was a slight initial leukocytosis during the second to fifth day, followed by a moderate leukopenia. As soon as the erythema started in the mucous membrane, the leukocyte drop was interrupted by a definite increase, lasting for several days. Following that increase, the number drops again and reaches its lowest level.

The variations in the leukocyte curve are mainly due to the number of neutrophil cells. The lymphocytes drop after the beginning of treatment, first quickly, then slower, to a minimum which is reached at the end of the treatment. The recovery is slow. In unfavorable cases, the lymphocyte count remains low. Monocytes, eosinophils, and plasma cells show slight and inconstant variations.

In cases which respond to the treatment, the blood returns to normal in about from two to four weeks following the treatment. The qualitative changes are not characteristic. The globulin curve runs inversely to the leukocyte curve. Comparing the blood changes with those in cases receiving one single massive dose, one gains the impression that with the protracted fractional dose method they are rather less, but certainly not more pronounced. Certain pathologic granula seen in the neutrophil cells are undoubtedly due to the resorption of decayed cells rather than to an injury of the bone marrow.

ERNST A. POHLE, M.D., Ph.D.

BONE (DIAGNOSIS)

Lead in the Growing Skeleton. Editorial. *Jour. Am. Med. Assn.*, June 6, 1931, XCVI, 1956.

It has recently been demonstrated that chronic lead poisoning, induced in childhood, may reveal itself in roentgenograms of the adolescent skeleton. Shadows appear at the growing ends of the long bones similar to those seen after continued administration of

phosphorus. The fact that lead produces such definitely recognizable changes in the bone, in process of formation, promises to have considerable diagnostic value in cases that have heretofore offered problems of considerable import. It has been shown that lead compounds can actually enter the skeleton. The fact that only those parts of the skeleton are affected which are in process of growth at the time of ingestion of the lead is proved by the entirely normal structure of the old bone proximal to the lesions, the sharp limitation of the lesions to the growing parts, and a degree of involvement at any point exactly proportional to the rate of growth at that point.

Only where growth occurs rapidly do the changes readily reach such magnitude as to show in roentgenograms. A new field of interest in relation to the dangers of the environment of childhood is thus opened.

C. G. SUTHERLAND, M.D.

Inorganic Blood Chemistry in the Osteochondritides. Joseph Buchman and Isaac F. Gittleman. *Am. Jour. Dis. Child.*, December, 1930, XL, 1250-1261.

In view of conflicting reports in the literature concerning inorganic blood studies in patients with various osteochondritides, the authors studied thoroughly forty-three cases. The material included instances of vertebral epiphysitis, osteochondritis of the vertebral body, Legg-Perthes' disease, Osgood-Schlatter's disease, Koehler's disease of the tarsal scaphoid, and cases of displaced femoral epiphysis. Several patients had multiple lesions, varying in form from mild to severe and in age from three to nineteen years. In all, determinations of calcium and phosphorus content of the serum were carried out, and in eight cases, additional potassium, magnesium, and sodium determinations were made.

No evidence of rickets in this series of osteochondritides was found, as was shown by the inorganic blood studies, and the inorganic phosphorus, calcium, sodium, potassium, and magnesium content of the serum was well within normal limits.

F. B. MANDEVILLE, M.D.

Primary Myelogenous Sarcoma Complicating Cystic Disease of the Humerus. Paul H. Harmon and Hugh McKenna. *Arch. Surg.*, June, 1931, XXII, 903.

They report a case of a woman, 65 years of age, who sustained a pathologic fracture of the humerus, which was later found to be cystic in character. This original fracture healed, and she later sustained a second pathologic fracture, the arm finally being amputated after developing changes which suggested malignancy.

On the positive evidence of bony periosteal lipping and the presence of a significant, although small, amount of stroma that could have been produced by potential osteoblasts, the diagnosis of an osteolytic myelogenous sarcoma is based. The majority of microscopic fields of sections of this tumor demonstrates a picture not inconsistent with myeloma, thus illustrating the deceptiveness of an incomplete histologic study of a malignant bone tumor. The authors consider this case as an instance of a malignant neoplasm, complicating a cystic disease of the bone.

HOWARD P. DOUB, M.D.

The Recognition of Accessory Centers of Ossification in the Transverse Processes of the Dorsal Vertebrae and the Persistence of These Centers in the Transverse Process of the First Dorsal. Gösta Gräberger. *Acta Radiologica*, 1931, XII, Fasc. 1, No. 65, pp. 77-84.

The author discusses the varying opinions of anatomists concerning the time of appearance and union of the centers of ossification in the transverse processes of the dorsal vertebrae, particularly the first. He has examined 200 patients between the ages of 10 and 20 years, and concludes that the accessory centers appear in the transverse processes between the ages of 11 and 14 years and are completely united, as a rule, between the ages of 18 and 20 years. He finds, however, that these accessory centers in the transverse processes of the first dorsal sometimes persist in later life.

The author has gone through the chest and spine films of 3,000 persons over 20 years of

age. Twenty-two of these (0.7 per cent) showed persistence of the accessory centers of the transverse processes of the first dorsal. There was unilateral persistence in the right side in 9 individuals (0.3 per cent), unilateral persistence in the left side in 6 (0.2 per cent), and bilateral in 7 (0.2 per cent). None of these cases had any symptoms and none of them presented any history of injury. The author believes that the condition is probably due to mechanical factors, such as deflection of the transverse processes upward or downward, scoliosis, muscular attachments, and vascular anomalies.

A. L. HART, M.D.

Flat Vertebrae (Platyspondylia: Presenile Osteoporosis). Franz Polgár. *Röntgenpraxis*, April 15, 1931, III, 346-357.

When a vertebra has decreased regularly and markedly in height, one may call it a "flat vertebra." The congenital and acquired types are not yet sufficiently known. A rare case of "microspendylia," or platyspondylia, is described in detail, and the difficulty of differentiating it from vertebra plana Calvé is emphasized. In this group are also described certain types of Kummell's disease and the vertebra plana Calvé. The flat vertebra may also be seen in the primary presenile osteoporosis; however, this usually leads to an hourglass-like deformity of the vertebra. The clinical picture is not well known and the etiology is not clear. The author suggests the name "kyphosis praesenilis osteoporotica."

H. W. HEFKE, M.D.

Fractures of the Posterior Tubercle of the Astragalus and of the Os Trigonum: A Clinical and Anatomical Study. Giuseppe Rotolo. *Clin. Chirug.*, December, 1930, XXXIII, 1375-1405.

In order to throw some light on the differentiation of Shepherd's fracture (fracture of the external posterior tubercle of the astragalus) from the os trigonum, the author reports, with radiographs, eight cases of fracture of the posterior tubercle of the astragalus and

four cases of os trigonum (2 bilateral and 2 unilateral), in two of which the latter had been fractured. These occurred among more than 200 cases of fractured arch of the foot and of the posterior tarsus, which leads the author to state that Shepherd's fracture occurs more frequently than does os trigonum. He also reports some studies carried out on a cadaver concerning the anatomy of the posterior calcaneo-astragaloid ligament.

The article is illustrated by thirty-one radiographs.

E. T. LEDDY, M.D.

A Peculiar, Apparently Hitherto Undescribed, Disease of the Long Bones of the Hand and Foot. H. Bergstrand. *Acta Radiologica*, 1930, XI, 596-612.

The author describes two cases of a disease involving the long bones of the hand or foot, both of which showed roentgenologic changes, suggesting osteogenic sarcoma, and both of which were operated upon with final complete recovery.

One of these patients was a 16-year-old girl, the other an 18-year-old boy. In neither case was there any history of a previous injury of which the patient was conscious. Each showed in the bone involved an irregular thickening, with the cortex showing through distinctly. One case revealed, in addition, irregular rarefaction and spicules along the border.

The author describes in detail the histologic findings in the tissue removed from both patients. The bone marrow and the blood-forming cells were completely absent. He believes the origin of these conditions lies in a disturbance of bone formation during embryonal life.

ALAN L. HART, M.D.

Spondylolisthesis, with Special Reference to the Industrial Case. J. Edgar Stewart. *Southern Med. Jour.*, April, 1931, XXIV, 317-321.

The author describes the pathologic anat-

omy, incidence, and clinical picture of this condition. The conclusive evidence is in the radiologic examination, and without radiograms the existence of the displacement can only be guessed at. Any patient complaining of a low-back disability or who has sustained an injury to the back should have roentgenograms in two planes, this being just as important in this region as about the extremity joints. The importance of the X-ray examination at a later date, when the examination following the injury was negative, is very strikingly shown by cases cited. The fifth lumbar vertebra will frequently be shown to have slipped forward some days or weeks following an injury, when nothing was visible on films made at the time.

W. W. WATKINS, M.D.

BONE (THERAPY)

Studies on Fractures of the Upper Extremity of the Humerus. Theod. Johner. *Schweiz. med. Wchnschr.*, March 21, 1931, LXI, 267-277.

Of 133 fractures of the humerus, 57, or 43 per cent, involved the upper extremity; 42, or 32 per cent, the shaft, and 34, or 25 per cent, the lower extremity. Fractures of the upper extremity of the humerus comprised 3 per cent of all fractures. They may be classified as supra- or infra-tuberculous, the former being very rare. No isolated fracture of the anatomical neck was found in this series, although in five cases it was associated with other lesions. In a series of 52 fractures of the upper extremity, 29, or more than one-half, were sub-tuberculous, and 17, or one-third, peri-tuberculous.

The author gives in tabulation form the type of trauma productive of each lesion, the resulting initial deformity as visualized in the roentgenogram, and the age distribution. He then discusses in detail the methods of treatment.

H. C. OCHSNER, M.D.

Bone Metastasis in a Case of Hypertrophic Pulmonary Osteo-arthritis. Axel

Renander. *Acta Radiologica*, 1931, XII, Fasc. 1, No. 65, pp. 29-40.

The author describes a case of hypertrophic pulmonary osteo-arthritis in a 48-year-old man who presented changes in several of the long bones. The left femur showed marked thickening and lamellation of the periosteum, which was, for the most part, distinctly divided from the cortex. There was rarefaction in the periosteal layer in the upper part of the femur, a similar condition being found in the central part of the bone. Some expansion of the periosteum over the rarefactions was noted, as well as similar changes in the other femur, tibia, fibula, humerus, and ulna, with a periosteal proliferation in the metacarpals and phalanges. The skull appeared normal.

The chest showed diffuse cloudiness in the middle and lower portions of the left lung field and infiltration, extending downward from the apex on the right. There was a small pleural exudate on the left. The lung condition was considered to be bronchiectasis, on a tuberculous basis, and the bone changes were regarded as secondary hypertrophic pulmonary osteo-arthritis.

One of the areas in the femur was excised. The pathologic report was: A cellular tissue resembling sarcoma which enclosed decalcified bone. There were also collections of epithelial cells resembling tubular glands, which were suggestive of metastatic carcinoma. The patient died of a gradually progressing cachexia in about two months.

The autopsy showed a malignant adenocarcinoma of the adrenal, with metastases to the left lung and the bones, while in the right lung and pleura there was evidence of typical caseous tuberculosis. The bony metastases were localized to the cortex of the bones and the periosteal deposits, instead of the marrow cavity, as is usual.

The author believes that the unusual localization of the bone metastases was due to the unusual vascularization in the periosteum produced by the inflammatory process therein. He also believes that the reason the bone metastases, in this case, were not more destructive, was probably the heightened function of the periosteum due to the chronic periostitis.

A. L. HART, M.D.

Disruption of Pelvis, with Luxation of the Innominate Bone. C. W. Peabody. *Arch. Surg.*, December, 1930, XXI, 971.

The author reports eight cases with separation and displacement of the entire, or nearly the entire, innominate bone. In five of these cases there was separation of the symphysis pubis, and also the sacro-iliac joint. In the remaining cases, there were fractures through the pubic arch, with separation and displacement of the sacro-iliac joint on the same side. One of these patients died, one was not traced, and the rest made a complete recovery. On going over the literature, the author found this to be a rather uncommon condition, with a serious outlook.

In this series the author used a method of reduction which is somewhat different from methods previously reported. As soon as the general condition warranted the use of an anesthetic, the patient was moved to the X-ray department and was placed on a tilting fluoroscopic table. The foot on the affected side was fastened firmly to the head of the table, and the table was then tilted upwards, almost to the vertical position, so that the weight of the body was almost entirely on the affected leg. Under fluoroscopic control, the pelvis was then manipulated until replacement could be seen as well as felt. A special webbing belt was then placed around the pelvis and buckled in place. The table was then returned to the horizontal position, the traction released, and the position again checked by the fluoroscope. The patient was then returned to his room on the Bradford frame, to the end of which his foot was re-attached, and the head end inclined downward. Twenty pounds of traction was maintained on the leg of the affected side. The binder was replaced by an overhead pelvic sling after return to the fracture bed. In two cases a recurrence of some of the rotation displacement at the symphysis occurred at the second month, which was due to moving the patient. In both instances operation with wiring of the symphysis pubis was then done.

In the six cases treated, all the patients recovered without any residual disability referable to the pelvic injury. In all cases, the

upward displacement of one side of the pelvis was corrected, and consolidation of the pelvic ring was obtained. In two cases, the relation at the symphysis was not entirely normal, and anatomic reposition at the point of fracture was not obtained.

HOWARD P. DOUB, M.D.

BONE DISEASES (DIAGNOSIS)

A Case of Arthropathy of the Shoulder with Syringomyelia. Hans Fritsch. *Röntgenpraxis*, April 15, 1931, III, 373, 374.

A case of syringomyelia is described, in which the head of the humerus was found to be entirely absent. The changes probably existed for many years previous to their detection, without causing symptoms, because of the anesthesia produced by the syringomyelia.

H. W. HEFKE, M.D.

III.—Correlation of the Roentgenologic Picture with the Gross and the Microscopic Examination of Pathologic Material in Congenital Osseous Syphilis. Stafford McLean. *Am. Jour. Dis. Child.*, March, 1931, XLI, 607-675.

This is the third paper of a series by the author on congenital osseous syphilis, in which the charts of sixteen syphilitic infants who came to autopsy are presented. In each of the sixteen cases evidence of pathologic changes in the bones was noted on the X-ray film. In all but two instances, the bone removed at autopsy for microscopic examination was selected because it presented the most marked evidence of the disease on the X-ray films. The bones of the lower extremities were used when possible, as they were more suitable for a microscopic comparative study. The specimens ranged from the earliest to the most advanced type of osteochondritis at the epiphyso-diaphyseal junction. The diaphyseal lesions ranged from slight cortical changes to well-marked symmetrical osteomyelitic lesions, involving a large area of the shaft. Periosteal changes and nearly every variety of pathologic

change of the bone in congenital syphilis of the first few months of life are demonstrated. The study of the roentgenograms, in conjunction with the pathologic material, has made quite clear and simple the explanation of changes in the bone seen by the X-ray films, which formerly were obscure.

F. B. MANDEVILLE, M.D.

IV.—The Correlation of the Clinical Picture with the Osseous Lesions of Congenital Syphilis as Shown by the X-rays. Stafford McLean. *Am. Jour. Dis. Child.*, April and May, 1931, **XLI**, 887-922 and 1128-1171.

This paper concludes a series of four articles by the author on the osseous lesions of congenital syphilis. The case reports and roentgenograms of 45 infants from 28 days to 22 months of age are included, with the case reports arranged according to age. In two cases, the roentgenogram revealed the diagnosis before a positive serologic reaction had been obtained.

The different varieties of lesions of certain bones, particularly the tibia, are illustrated and the selectivity of the disease for certain parts of the bones and for certain bones, as well as the curious selectivity in the onset of healing, are brought out by the author.

The type of lesion that by the X-rays simulates rickets and the type simulating scurvy are illustrated. The evolution of the osseous lesions and the relationship and disrelationship between cutaneous and visceral manifestations and osseous lesions are discussed.

The different types of saw-tooth metaphyses and various examples of "epiphyseal separation" are shown.

F. B. MANDEVILLE, M.D.

A Study of Bone Tumors in Ex-service Men. Philip B. Matz. *United States Vet. Bureau Med. Bull.*, April, 1931, **VII**, 321-336.

The author analyzes 45 cases of bone tumors occurring in ex-service men. In this series 38, or 84.5 per cent, were cases of osteogenic sarcoma; 5, or 11.1 per cent, were benign giant-

cell tumors; one case was an unclassified sarcoma, and one case was a benign osteogenic tumor. The question of hereditary susceptibility was also studied and in no case was there a positive family history of either malignancy or sarcoma. It was found that in 13, or 28.9 per cent, a positive history of trauma was obtained and that the period of time intervening between the trauma and the first symptoms of this condition varied from less than one month to forty months. The average age of the 45 cases at the time of diagnosis was 24.7 years. The average age of the 13 living cases was 37 years, while that of the group that died was 27.4 years.

The lower end of the femur and the upper extremity of the tibia were the most common locations of the involvement of this condition. Metastases were present in 55.6 per cent of the 45 cases. The highest incidence of metastases was noted among the mixed-cell type of osteogenic sarcoma. In reviewing the diagnostic symptoms and signs of bone tumors as recorded in the histories, it was noted that pain, swelling, and loss of function were the most frequently observed. In 19 instances the roentgenogram was suggestive of bone tumor, while in the remaining 26 cases of the series there was no record of a roentgenologic examination.

In the treatment of the 38 cases of osteogenic sarcoma, amputation was the surgical procedure in 28 instances and of this number 5 patients are alive. Other surgical procedures included disarticulation, resection of the bone, excision of the tumor, and curettement. Two patients with osteogenic sarcoma received either X-ray or radium only, and both of these patients are dead. Sixteen cases of osteogenic sarcoma received X-ray or radium or both in addition to undergoing surgical operation, and of this number, two are alive. One case that received Coley's toxins only is dead, and two that received Coley's toxins, in addition to surgical treatment, are alive.

J. N. ANÉ, M.D.

Two Cases of Achondroplasia. N. Mesz, J. Fliederbaum, and R. Markuszewicz. *Acta*

Radiologica, 1931, XII, Fasc. 1, No. 65, pp. 59-76.

The authors describe the physical characteristics and the roentgen examinations of two cases of achondroplasia: one, a man of 47 years, the other, a boy of 16 years. Both exhibited many of the usual features of this type of dwarfism. The first case also presented a definite familial inheritance of dwarfism. There is an extensive discussion of the Continental literature on the possible causes of this condition.

The opinion of the authors is that achondroplasia is due to pituitary dysfunction. One of their cases had no sella in the roentgen films, and the other had a small deformed sella.

A. L. HART, M.D.

Shadows Produced by Lead in the X-ray Pictures of the Growing Skeleton. Edwards A. Park, Deborah Jackson, and Laslo Kajdi. Am. Jour. Dis. Child., March, 1931, XLI, 485-499.

The authors note that lead, when taken for a sufficiently long period in sufficient dosage, can apparently produce changes in the bone in process of formation, which are reflected in roentgenograms as shadows of increased density. The clouding is most conspicuous where growth is occurring most rapidly, namely, at the anterior ends of the middle six ribs, the lower ends of the femora, the upper end of the humerus, the lower ends of the radius and ulna, and at both ends of the fibula and tibia. The fact that only bone in process of growth is affected must mean that the lead either enters into the chemical composition of the bone or influences cellular activity in such a way that the character of the bone formed becomes altered. Several studies bring forward strong indirect evidence that the place of deposit is the trabeculae, lying in close proximity to the cartilage. From a study by the authors of two autopsy cases, they suppose that the lead modified the endochondral ossification in such a way that the trabeculae formed under the cartilage a much denser thickening than normally, and that these formations of densely packed trabeculae were the cause of the band-

like shadows. They admit, however, the probability that lead itself was in the trabeculae and may have been partly responsible for the shadows. In the four cases roentgenographed, band-like shadows were noted in all of them.

F. B. MANDEVILLE, M.D.

Joint and Bone Changes in Hemophilia. Erich Forfota. Röntgenpraxis, May 1, 1931, III, 399.

One of the symptoms of hemophilia is the characteristic change in the joints and bones caused by repeated hemophilic hemorrhages. The changes seen roentgenologically are numerous and varied. Two cases are described in detail. X-ray examination of the knees in the first case showed atrophy of the bones, narrowing of the joint spaces, well-circumscribed areas of bone destruction (cysts), and arthritic spurs. Similar changes were also seen in the right elbow. The second patient showed the identical picture in both knees and elbows. Examination of the pelvis revealed multiple large cystic areas in the right ilium. Fourteen years previously the patient had had a severe hemorrhage in the region of the right hip. At the time of examination there was a large palpable tumor in the pelvis, which contained liquid blood. These atypical bone changes can best be explained by erosion of the bone by large hemorrhages which have persisted over a long period of time.

H. W. HEFKE, M.D.

A Case of Monoarticular Chondromatosis of the Skeleton. Robert Kienböck. Röntgenpraxis, May 1, 1931, III, 406.

There are cases of chondromatosis of the bones in which a single region of the body, especially a joint region, is attacked by multiple tumors of the same kind, namely, monoarticular chondromatosis. Such cases may be classified between the solitary tumors and the generalized or unilateral disease of the skeleton. Even if the tumors grow enormously large, a lasting arrest in the growth may take place, a fact which is important for prognosis and therapy. In the case described, an interval of fifteen years showed no progress in the

size of the growth, which had attacked the humerus, radius, and ulna near the elbow joint. One can usually make a diagnosis with certainty, and can differentiate it from malignant sarcoma and benign osteitis fibrosa cystica.

H. W. HEFKE, M.D.

Staphylococcus Albus Septicemia with Osteomyelitis of the Pubic Bone. Lee Bivings. *Am. Jour. Dis. Child.*, December, 1930, XL, 1262-1268.

Septicemias caused by *Staphylococcus albus* are rather uncommon. They are usually accompanied by numerous complications in the form of metastatic abscesses, and frequently terminate fatally. Osteomyelitis of the pubic bone from any cause is rare. McWhorter has reviewed ten cases, four of which were his own. One patient died, but the others survived after complicated and protracted illness.

The author reports a case of a boy, seven years of age, who was infected with *Staphylococcus albus*, following the crushing of a furuncle on his knee. Roentgenograms demonstrated an osteomyelitis of the ascending and descending rami of the right pubic bone, and the progress of the condition is shown in a series of films. Metaphen was given intravenously every eight hours for seven times, the dosage begun with 5 c.c. of a 1:1,000 solution and gradually increased to 10 cubic centimeters. It was interesting to note that the white cell count continued to climb daily as metaphen was given, and that it began to fall immediately after this drug was discontinued. No conclusions as to the efficacy of this treatment were drawn from this one case.

F. B. MANDEVILLE, M.D.

Streptococcal Infections of the Epiphyses and Short Bones: Their Relation to Köhler's Disease of the Tarsal Navicular, Legg-Perthes' Disease, and Kienböck's Disease of the Lunatum. D. B. Phemister, Alexander Brunswick, and Lois Day. *Jour. Am. Med. Assn.*, Oct. 4, 1930, XCV, 995.

Bacterial studies have been undertaken in a

group of obscure but kindred necrosing bone lesions, among which are Köhler's disease of the tarsal navicular, Legg-Perthes' disease, and Kienböck's disease of the carpal semilunar, in an endeavor to throw some light on their etiology. The most feasible causes to which they have been attributed may be grouped under the headings of infection, embolism, and trauma. Axhausen considers the condition an anemic infarction from a mycotic embolus or a thrombus, but without bacterial infection of the field.

In the few cases in which cultures have been made, they have usually been reported as sterile. In this series, cultures were taken in two cases, each of Köhler's disease of the tarsal navicular bones, Legg-Perthes' disease, and Kienböck's disease of the lunatum. Streptococci grew in the cultures of four cases: one of Köhler's disease, one of Legg-Perthes' disease, and two of Kienböck's malacia. In one case of Köhler's disease in a child with multiple osseous and glandular tuberculosis, the cultures were sterile and guinea-pig inoculations were negative for tuberculosis. The cases are discussed in detail.

The authors' observations suggest that streptococci play an important rôle in the etiology of these diseases but that other factors bring them about. Whether the streptococci reach the bone in an embolus which blocks the main artery or whether they lodge there alone remains undetermined.

CHARLES G. SUTHERLAND, M.D.

CANCER (DIAGNOSIS)

Sinus Tract Carcinoma. Ernest M. Watson. *Jour. Urol.*, May, 1931, XXV, 469-486.

The author reports two cases of primary carcinoma in suprapubic sinuses, which followed many years after suprapubic cystotomy for urethral stricture. The strictures were of traumatic and gonorrheal origin, respectively. Secondary infection had been present for several years and, undoubtedly, might have played a part in the production of the carcinomatous condition. In one case treated by excision, radium, and deep X-ray, the patient died

of generalized carcinomatosis within three months' time. The other, having lived two years after treatment by radium implantation and deep X-ray, finally died in uremia, following an operation for hernia without clinical or palpatory evidence of carcinoma.

In the discussion of the paper by Dr. J. D. Barney, Dr. G. G. Smith, and Dr. C. H. De T. Shivers, the consensus of opinion regarding carcinoma of the penis was that partial or complete surgical amputation with gland resection was advisable, except in the very earliest of cases. That the deeper lymphatics might be involved, even if the more superficial inguinal glands were negative, was one of the possible complications to consider in contemplating extensive surgery.

Dr. Barney stated that in 85 per cent of reported cases of carcinoma of the penis, phimosis of long duration had been present. No individual who had been circumcised in infancy or early childhood had ever been known to develop carcinoma of the penis.

Dr. G. G. Smith emphasized the singular lack of local recurrence, and in cases which one was unable to keep under constant close observation, he felt safe in advocating amputation about half way down the shaft, with dissection of both groins.

Dr. C. H. De T. Shivers advised thorough dissection of the inguinal glands not only in advanced cases but believed the best results to be obtained by carrying out this procedure, even in early cases. He felt that amputation from two to three centimeters beyond the lesion was sufficient to prevent local recurrence. The Doctor preferred to depend upon radical dissection rather than radium or X-ray treatment to effect a cure.

DAVIS H. PARDOLL, M.D.

Carcinoma of the Penis. Fletcher H. Colby and George G. Smith. *Jour. Urol.*, May, 1931, XXV, 461-467.

The authors have attempted to correlate the clinical course of carcinoma of the penis and the histological aspect. They conclude, from a series of 50 cases, that there exists a definite correlation between the grade of malignancy and the clinical course in carcinoma of the

penis. Their evidence is based on the fact that a greater percentage of the cases of low malignancy have lived for a longer period of time following operation than cases of high malignancy. In addition, there appears to be less tendency for the cases of low malignancy to involve the regional lymph nodes. Dissection of the groin is usually found to be advisable, except in the earliest cases. The latter are amenable to more conservative surgical measures or radiation, with a reasonable expectation of cure. Phimosis was present in nearly 50 per cent of the cases and might be regarded as possessing some relationship to the development of cancer in this region. The average age was fifty-nine years, the youngest patient being thirty-nine and the oldest ninety. One-third of the patients were between the ages of forty and fifty.

DAVIS H. PARDOLL, M.D.

Mammary Cancer. Charles A. Vance. *Southern Med. Jour.*, February, 1931, XXIV, 112-114.

The prognosis in mammary cancer depends upon the length of time the disease has existed when the patient comes to operation, the thoroughness of the operative procedure, and, perhaps, the virulence of the disease. Theoretically, if the diagnosis is made prior to the occurrence of metastases to glands or elsewhere, and radical operation is performed at once, there should be no recurrences and no deaths. In every case of mammary cancer, careful X-ray examination of the chest and long bones should be made, as metastases sometimes occur very early. There is yet no consensus of opinion in regard to either pre-operative or post-operative X-ray therapy. The author's personal feeling is that X-ray is beneficial when used both before and after radical operation.

W. W. WATKINS, M.D.

Primary Carcinoma of the Lungs. IV.—Intracranial Metastases. B. M. Fried and R. C. Buckley. *Arch. Path.*, February, 1930, IX, 483-527.

Metastases to the central nervous system

were found in fifteen of thirty-seven cases with bronchiogenic cancer. For eleven of the fifteen cases, a diagnosis of primary tumor of the brain was made, and the bronchiogenic tumor was overlooked.

It is believed that when a person of middle age has an abrupt onset of symptoms and signs of a rapidly developing intracranial lesion, a metastatic cerebral lesion should be thought of, the lungs being the most common site of the primary lesion. It is realized, moreover, that even in instances in which the examination of the lungs yields negative results, the presence of a primary tumor in these organs cannot be excluded.

The authors believe that metastases occur by way of the blood stream.

A. O. HAMPTON, M.D.

CANCER (THERAPY)

Histology of Buccal Carcinoma in Relation to Prognosis and Radiosensitivity. Ralph Phillips. *Lancet*, Jan. 17, 1931, CCXX, 118.

Many pathologists consider that the explanation of radiosensitivity and radioresistance is to be found in the histology of the cancer cell. The present paper is an attempt to find a histological explanation of the fact that local healing of carcinoma of the tongue is obtained in less than half the cases treated by irradiation.

In order to have a firm background for the work, it was first necessary to prove a relationship between the histology of the tumor and its clinical course. If it is possible to classify, with some constancy, the degree of histological differentiation in a carcinoma, it might perhaps be expected that such a classification would be correlated with events such as the following: (1) The rate of growth of the tumor; (2) the duration of life from the detection of the growth; (3) the tendency to dissemination; (4) the time of appearance of metastases; (5) the results of operative treatment; (6) the reaction to radiotherapy.

The life-history of the malignant cell is then discussed, with the relationship of the rapidity of growth of the tumor and the degree of differentiation and specialization. The author

discusses Broders' classification and quotes Ewing as stating that the idea of dedifferentiation is an unwarranted assumption and contrary to sound biological principle. Another criticism of Broders' classification is that a malignant growth is not uniform in structure throughout, and that, therefore, no single histologic section is of value as an index of malignancy. The author specially investigated this point, and found that such a contention was completely untrue, at least for buccal carcinomas. Several growths were sectioned serially, and in many, two sections from different parts of the growth were taken. In every case uniformity of the growth was found, and further, the lymph gland metastases were in nearly every case uniform in structure with the primary growth. He considers it remarkable that the structure of a carcinoma is so rigid that its metastases reproduce not only its coarsest but even its finest histologic characteristics.

The material investigated consisted of all the cases of carcinoma of the lip, tongue, floor of mouth, tonsil, and palate treated in St. Bartholomew's Hospital, between 1921 and 1927, so that three years at least have elapsed for the estimation of results. In addition, cases treated by irradiation in the years 1928 and 1929 were studied from the point of view of healing of the primary lesions. All the available histologic sections were collected and graded according to Broders. The same was then done independently for the lymph glands, where these had been removed and sectioned, and, lastly, the clinical notes of the patients were abstracted, and cases in which no pathologic section had been taken were included for completeness. As the meaning of the stroma reaction is obscure, and conflicting views are held, it was decided to confine the investigation to the malignant cells alone. Of 319 patients, 71 were treated by radiotherapy and followed up for one year or more to discover the effect on the primary growth. Of the 248 which remained, 208 were followed up for three years or more. Out of 286 patients operated upon, 40 untraced cases and eight post-operative deaths were excluded from the follow-up results. Tabulations are given show-

ing the histologic grade and primary site. It was found that the histologic grading agrees with the clinical prognosis, and that there was a direct correlation between the grade and the interval between the patient's first symptom and his seeking of advice, as the delay in seeking advice is usually inversely proportional to the rate of growth. The prognosis of operative growths also shows a direct correlation with the prospect of cure. The percentage of three-year cures in each grade was as follows: (1) 34.8, (2) 29.3, (3) 16.3, and (4) 5.9 per cent; for five years, grade (1) 33.3, (2) 23.7, (3) 10.3, and (4) 0.

Tabulations are given showing the criteria of grading with regard to the number of cell-nests, keratinized cells, squamous cells, prickle cells, mitoses, etc., for the relation of the primary site of the histologic grade, for the relationship between histologic classification and clinical course, and for the effect of irradiation upon primary carcinoma, according to its histologic grade. There is also a tabulation showing the response of the primary lesion to irradiation, according to the degree of round-cell infiltration. No relationship was found between the reaction of the primary growth to irradiation and the degree of round-cell infiltration of the stroma. Of all the grades treated by irradiation 45.1 per cent are shown as healed, and by grades as follows: (1) 50 per cent, (2) 40 per cent, (3) 40 per cent, and (4) 61.5 per cent. In the few cases that the author has been able to observe, the changes in the epithelioma following irradiation have shown in a striking manner the rapid differentiation of the malignant cells into keratinized cells; these latter die and are absorbed by polymorphonuclear phagocytosis. Two cases in which the lymphatic glands containing metastases were excised after the irradiation showed that the metastases were of a lower histological grade than the primary growth, i.e., had undergone greater differentiation.

Thus the action of irradiation may be summarized as follows: (1) The actively dividing cells (the embryonic types) are destroyed by direct action. (2) The differentiating, more adult type of cell is speeded up at the differentiation, becomes keratinized, and so

dies—that is, it is destroyed by indirect action. From this, he considers the practical application of his findings to be as follows: The best method of irradiation is the one adapted to the histology of the cancer under treatment—with Grade 1, small doses acting for a long time. For Grades 2 and 3, a moderate intensity over a moderate time is suggested, or perhaps a combined X-irradiation with radium, and for Grade 4, a high intensity for a short time.

H. J. ULLMANN, M.D.

Eleven Years' Experience with Radium Treatment of Carcinoma of the Cervix at the Woman's Hospital: Statistical Report. G. G. Ward and L. K. P. Farrar. *Surg., Gynec. and Obst.*, February, 1931, LII, No. 2A, pp. 556-559. (Reprinted by permission from *British Med. Jour.*, May 9, 1931, No. 3,670, p. 89 of *Epitome of Current Medical Literature.*)

The authors, reporting a series of 251 cases of cervical carcinoma treated with radium, remark that the leukopenia induced by this therapeutic method necessitates steps being taken to fortify the patient's resistance against septic infection, and so against the unpleasant sequels that may otherwise be associated with the absorption of the post-radiation slough. Each case is carefully examined at monthly intervals after radiation, in order to detect signs of early recurrence in the form of small nodules or erosions, and also to deal with the possible complication of pyometra in its first stages. The authors conclude, as the result of their eleven years' experience, that in carcinoma of the cervix the best results can be obtained by employing the smaller dosages of radium (2,400 to 4,200 mg.-hrs.), provided that the cases are re-examined at frequent intervals during the subsequent five years, and that recurrences are dealt with at once by renewed radiation. Any cachexia or anemia should always be treated in advance by blood transfusion if the red corpuscles have fallen below 3,500,000 per c.mm. and the hemoglobin percentage below 50.

The authors hope that high voltage X-ray

therapy will prove efficacious in dealing with the 40 per cent incidence of gland involvement in the advanced cases. In all patients whose disease has progressed beyond the cervix, surgery is prohibited. Their results with radium have been fully equal to the surgical figures of successes, but without the high primary mortality and morbidity. They doubt whether the method of following radium treatment by vaginal hysterectomy and X-radiation gives results good enough to compensate for the high primary mortality of this procedure.

The Medical Care of the Cancer Patient. Henry Jackson, Jr., and George R. Minot. *Am. Jour. Cancer*, January, 1931, XV, 6-11.

The authors discuss the responsibility of the general practitioner in the prevention and care of cancer, and stress the necessity for preventive medicine in malignant disease. The importance of the general medical care of the cancer patient is emphasized. They believe that "maintenance of their health [the cancer patients'] in the best possible state by every reasonable means may indeed perhaps play a rôle in the prevention of possible recurrence and certainly can add to the sense of well being."

JOHN R. CARTY, M.D.

Statistical Contribution to Carcinoma of the Uterus and its Treatment. A. Pfleiderer. *Strahlentherapie*, 1931, XL, 13.

During the last 29 years, of the 37,535 patients seen at the Women's Clinic at the University of Tübingen, 1,554, or 4.14 per cent of all cases, suffered from cancer of the uterus (1,251 in the cervix, 303 in the fundus). It was interesting to note that during the War there occurred a drop in the number of cancer patients. How much the different diet may have been responsible for this is difficult to state. A study of the heredity showed cancer in the family in 89 out of 1,045 cases (8.6 per cent). The combination of tuberculosis with cancer was also striking, being 18.1 per cent since 1923. Constitutional factors seem to be of some influence.

There was a higher percentage of cancer in women who began to menstruate late and entered the climacteric at a later age. In those with cancer of the fundus, the climacteric seems to occur later than in those with cervical cancer. A survey of the age records shows that most cervical cancers appear between the ages of 35 and 65, with a peak during recent years at from 46 to 50 years. In older women, cancer of the fundus is apparently more malignant and gives a poor prognosis. The relations between pregnancy and cancer were quite definite. In patients with cancer of the cervix, 1.6 per cent were sterile, as compared with 13.3 per cent of the patients with cancer of the fundus; 3.8 per cent of the cervix cancer cases and 28.7 per cent of the fundus cancer cases never became pregnant. A high number of pregnancies evidently predisposes to cancer of the uterus. The inoperability in cancer of the cervix amounted to 36.1 per cent, with a 6 per cent fluctuation, and for fundus cancer to 17.8 per cent, with a 19 per cent variation.

The number of inoperable cases seems to have increased since 1920. The statistics of the end-results are based on a total of 956 cases treated during the years from 1902 to 1923. Six hundred and fifteen (4.3 per cent) were operable and 341 (35.7 per cent) were inoperable. The number of absolute cures amounted to 186 patients out of 956 cases, or 19.4 per cent. The figures for relative cures were as follows: Of 615 operable patients, 181 were cured (29.4 per cent), and of 341 inoperable cases, 5, or 1.4 per cent, were cured. The results following radical operation (Freund and Wertheim) without irradiation were 132 cured out of 445, or 29.6 per cent. If the operative cases without irradiation are combined with those which received post-operative radiation therapy, these figures changed to 181 cured patients out of 553, or 32.7 per cent. The primary mortality of the radical operation was 19.1 per cent. Two hundred and one out of 339 patients who did not receive post-operative radiation therapy developed a recurrence (59.2 per cent). Ninety-five cases were irradiated following operation, and 50 of them (52.6 per cent) had a recurrence. The rela-

tive merit of the radiation therapy amounted to 6.8 per cent in the operable and 2.4 per cent in the inoperable cases.

The number of cases of fundus cancer was 216; 176 of these (81.4 per cent) were operable and the remaining 40 (18.6 per cent) were inoperable. The absolute number of cured patients was 85 out of 216 cases, or 39.3 per cent. The figures for the relative cures were zero for the inoperable cases and 85 out of 176, or 48.3 per cent, in the operable cases. Radical operation cured 66 (48.1 per cent) out of 137 patients. Radical operation and post-operative irradiation cured 84 out of 163 cases, or 51.5 per cent. The primary mortality of the cases operated upon was 9.8 per cent.

ERNST A. POHLE, M.D., Ph.D.

CATHODE RAYS

The Effects of High Voltage Cathode Rays on the Germinal Epithelium of the Rat. Victor C. Jacobsen. *Arch. Path.*, May, 1930, IX, 967-983.

A study was made of the effects of cathode rays of high voltage on the germinal epithelium of the male adult white rat. The shaved scrotal area was exposed in front of the anodal window of the Coolidge cathode-ray tube at voltages of 200,000 and 250,000, with a current of 1 milliampere. The length of the exposure varied from five-tenths of a second to thirty seconds. The changes in the scrotal skin were similar to those in the abdominal skin as described previously by Waddell and Jacobsen.

Doses sufficient to produce dry necrosis of the skin cause lesions in the seminiferous tubules in a zone about 0.6 mm. in depth. The lesions consisted of degenerative and necrotic changes resembling those caused by roentgen rays. The tela subcutanea, below the upper 0.2 mm. of the skin, and the tunica vaginalis testis showed no evidence of injury, indicating clearly the much greater sensitivity of germinal epithelium to this form of irradiation.

These observations are offered as further biologic evidence that the effects of roentgen rays are not due primarily to the roentgen rays but to the electrons or cathode rays set free in the tissues.

A. O. HAMPTON, M.D.

The Physics and Technic of Cathode Rays. Paul Knipping. *Strahlentherapie*, 1930, XXXV, 391.

This is an excellent brief presentation of our present knowledge of cathode rays. The author has written it in such a manner that every physician can understand it without requiring the knowledge of higher mathematics. It is recommended, therefore, for study in the original.

E. A. POHLE, M.D., Ph.D.

CHEST (DIAGNOSIS)

Post-operative Pulmonary Atelectasis. A. Lincoln Brown. *Arch. Surg.*, June, 1931, XXII, 976.

It is fairly well agreed that bronchial obstruction plus decreased aëration ability of the lung are prime causes of post-operative pulmonary atelectasis, and that the obstruction is usually due to retained tracheobronchial secretions.

The author believes that bronchial secretions, as a cause of pulmonary atelectasis, have not been given sufficient consideration. He says that whereas coughing usually expels material from the tracheobronchial tree, it may under certain conditions actually bring about the opposite result; that is, drive the material deeper. He also notes that the degree of penetration of the material into the smaller ramifications of the tracheobronchial tree is in direct proportion to the viscosity of the material in question. With extremely viscid material the large bronchi are obstructed, and as the secretion becomes less viscid, the obstruction recedes to the smaller bronchi, and, finally, if it is of watery consistency, one obtains clinically the condition which has been spoken of as "drowned lung."

He thinks that the incidence of pulmonary

atelectasis is much greater following spinal anesthesia than following any form of inhalation or regional anesthesia. This may be due to the facts that (1) spinal anesthesia definitely inhibits the depth and force of respiratory movements which tend to rid the tracheobronchial tree of foreign matter or secretions; (2) the normal viscosity of the secretions of the tracheobronchial tree appears to be increased following spinal anesthesia, and (3) the patient tends to remain relatively quiet for a number of hours following spinal anesthesia.

HOWARD P. DOUB, M.D.

Chronic Bronchitis. Wendell P. Dally. *United States Vet. Bureau Med. Bull.*, March, 1931, VII, 250, 251.

The author considers that the inhalation of dust plays a greater rôle in the etiology of pneumoconiosis than as a causative factor of chronic bronchitis. While the symptoms of the two conditions are similar, the physical signs and roentgenographic evidence in pneumoconiosis are somewhat comparable to an advanced case of tuberculosis. The roentgenogram shows definite defined areas of mottled masses throughout the lung but especially in the hilus region. In chronic bronchitis, with the exception of an increase of fibrotic striations, and in old emphysematous cases, the roentgenogram shows little or no change from the normal.

The symptoms of chronic bronchitis vary from no respiratory distress to extreme embarrassment, with distressing paroxysms of coughing. The morbid anatomy may vary from a mild chronic passive congestion of one or more lobes to definite fibrotic changes involving practically the entire peribronchial structure. Usually the bronchial tubes are more or less dilated and the mucous membranes congested, and in later stages numerous areas of bronchiectatic cavitation exist. As a result of long continued coughing, the lung structure loses its elasticity and the constant over-supply of residual air gradually dilates the air-cells, so that eventually fibrosis and emphysema are seen.

The author urges caution, especially in the

earlier cases of chronic bronchitis, as there is ever the possibility that one may be dealing with a definite tuberculous infection. Inspection, palpation, and percussion in the early case of chronic bronchitis are of little or no help. When auscultation reveals roughened or exaggerated breath sounds, which are general throughout the chest, one may diagnose a mild degree of chronic bronchitis.

The treatment of chronic bronchitis is directed toward general measures, as removal of foci of infection, proper ventilation, breathing exercises, tonics, air baths, and sun baths. Sedatives and expectorants should be employed when indicated. In rather old cases in which bronchiectasis is in evidence, the application of lipiodol has given beneficial results.

J. N. ANÉ, M.D.

Roentgenographic Examination of the Chest, with Case Reports. Marjorie Wulff and J. Arthur Myers. *Med. Jour. and Rec.*, Dec. 3, 1930, CXXXII, 527-529.

Two types of cases are discussed: (1) Those that have mild symptoms from time to time, but in which no evidence of pathology can be detected, except definite calcium deposits in the region of the lung hili, with or without accompanying Ghon tubercles. (2) The second group has the same findings, but in the family there is tuberculous infection which has spread to nearly all members and one or more clinical cases of tuberculosis has appeared. The chest findings in these two groups warrant far more consideration than they have received.

W. W. WATKINS, M.D.

Aneurysm of the Descending Aorta Simulating Lung Tumor. Clerc, Haret, and Frain. *Bull. et Mém. Soc. Radiol. Méd. France*, April, 1931, XIX, 164-167.

Preliminary X-ray films and fluoroscopic examination revealed a large mass in the lung, extending slightly to the right but mainly to the left of the cardiac borders in the region of the left auricle. The mass did not pulsate

and the borders were smooth. A lung tumor was suspected and radiotherapy was instituted. The patient died of a tuberculous cachexia three months later. The autopsy examination revealed an enormous aneurysm of the descending aorta, which was completely filled by a large thrombotic blood clot—hence no pulsation. The aneurysm had eroded the anterior surfaces of several contiguous vertebrae.

CHARLES S. CAPP, M.D.

Pneumoconiosis: The Delayed Development of Symptoms. James A. Britton and Jerome R. Head. *Jour. Am. Med. Assn.*, June 6, 1931, XCVI, 1938-1940.

The authors report four cases of silicosis, or silicosis and tuberculosis, which developed many years after relatively short exposures. Once a man has developed symptoms while still engaged in a dusty occupation, stopping the work does not prevent the gradual steady progression of the pathologic changes.

The question raised by these cases is of great importance from the point of view of industrial hygiene and from that of the legal aspect of industrial medicine. One developed symptoms of silicosis twenty-three years after an exposure of four months; a second, ten years after an exposure of two years; a third, fourteen years after an exposure of four years; the fourth, ten years after an exposure of ten years. These instances suggest the necessity of revising the conception of the length of exposure which is necessary to produce the disease. It seems probable that after relatively short exposures sufficient dust may be deposited in the lungs to set up a progressive fibrosis, which only after many years becomes sufficiently extensive to produce symptoms.

C. G. SUTHERLAND, M.D.

Aneurysm of the Pulmonary Artery. H. R. Wahl and Raymond L. Gard. *Surg., Gynec. and Obst.*, June, 1931, LII, 1129-1135.

Because of the extreme rarity of this condition, the authors' case is reported in detail, having been observed during a period of three

years, and studied by X-ray and the electrocardiograph. The autopsy findings clear the diagnosis and explain the clinical symptoms. Clinical diagnosis of pulmonary aneurysm is very difficult, and in only one case reported was an antemortem diagnosis proved by autopsy.

The authors quote Henschen, who says the following signs are simultaneously present in pulmonary aneurysm:

"(1) Prominence of the second and third left costal cartilages, with well-defined dullness and X-ray shadow in this area;

"(2) Intense cyanosis, other signs of congestion, hemoptysis, and substernal pain;

"(3) Pulsation and well-defined thrill and murmur in the second left interspace;

"(4) Loud, superficial, rasping systolic murmur.

"(5) Right-sided cardiac hypertrophy;

"(6) Absence of dilatation or hypertrophy of the left heart [*i.e.*, apex dullness within the mid-clavicular line];

"(7) Absence of usual signs of aortic aneurysm [*viz.*, dullness to right, difference in pulse, recurrent laryngeal paralysis]."

But in the case reported there was no pulsation in the left second interspace, due to almost complete thrombosis.

Brief reports of fourteen other cases found in the literature are given.

D. S. CHILDS, M.D.

Hydatid Cyst of the Lung. Picot. *Bull. et Mém. Soc. Radiol. Méd. France*, April, 1931, XIX, 171-173.

A twenty-year-old Arab had frequent hemoptysis, and on examination sonorous râles in the right lower lung were revealed. The X-ray films showed an ovoid uniform density, two interspaces wide, in the middle of the right lung. The pre-operative diagnosis was a dermoid cyst or sarcoma. A two-stage thoracoplasty was performed, with evacuation of a hydatid cyst. On autopsy examination, a second large unsuspected hydatid cyst in the abdominal cavity was discovered.

CHARLES S. CAPP, M.D.

CONTRAST MEDIA

The Roentgenologic Demonstration of the Lacrimal Ducts by Means of a New Contrast Medium. H. Gasteiger and S. Grauer. *Röntgenpraxis*, May 1, 1931, III, 410.

Roentgenologic examination of the lacrimal ducts, which have been filled by a thorium dioxyd sol, containing 50 per cent thorium, is highly recommended by the authors. The injection is easy, harmless, and the medium casts a good shadow. The position and type of a suspected stenosis may easily be demonstrated and fistulas also may be shown. Traumatic changes and anomalies are easily demonstrable. The roentgenologic diagnosis has been of great assistance, and the authors prefer to use this method.

H. W. HEFKE, M.D.

Paths of Absorption and Excretion of Sodium Tetraiodophenolphthalein. A. J. Delario. *Jour. Lab. and Clin. Med.*, January, 1931, XVI, 329-340.

Experimental work on the paths of absorption and excretion of sodium tetraiodophenolphthalein reveals the following facts:

(1) Dye is absorbed by both the small and the large intestine after oral or rectal administration.

(2) Dye given intravenously leaves the blood stream in from two to four hours. An occasional trace is found later as it is reabsorbed from the intestine or gall bladder.

(3) The liver starts to excrete the dye in one or two hours. It reaches its maximum concentration in the bile in five hours without the gall bladder, and in seven hours with a gall bladder *in situ*.

(4) The liver will excrete the dye a little at a time for six or seven days.

(5) The liver excretes about from 60 to 70 per cent of the dye, probably as sodium tetraiodophenolphthalein, without changing or conjugating it.

(6) Urine excretes about from 5 to 10 per cent of the dye—some in the inorganic state.

(7) The large intestine excretes about 25 per cent of the dye.

(8) Some dye is rendered insoluble as the dye-containing bile strikes pancreatic juice.

(9) Fat causes a greater amount of the dye to be rendered insoluble in the small intestine, more liver secretion of the dye, and probably a greater gall-bladder absorption.

A. O. HAMPTON, M.D.

DOSAGE

Roentgen Dosimetry. Grebe. *Schweiz. med. Wchnschr.*, April 25, 1931, LXI, 406.

The author discusses the methods of measurement, considering chemical changes, biological effects, and changes in the electrical charges of gases.

H. C. OCHSNER, M.D.

Multiplication of the Effect of Very Small Radium Doses on Tissue Cells *in Vitro*. Albert Fischer and M. Horwitz. *Strahlentherapie*, 1931, XL, 465.

Tissue cultures of osteoblasts were irradiated with such small doses of radium that no definite effect could be shown. If the exposed cultures were placed in the icebox, an effect of the irradiation could be detected. Arsenic acid in concentrations of $1:3 \times 10^6$ up to $1:9 \times 10^6$ had the same influence. Heat did not affect the cultures in this manner. It is concluded from these experiments that the effect from very small doses of radiation on biological objects can remain latent and become apparent only after the action of an otherwise harmless agent.

ERNST A. POHLE, M.D., Ph.D.

The Influence of Cones on the Dose. Stephan Epstein. *Strahlentherapie*, 1931, XL, 493-507.

The influence of cones on the dose in X-ray therapy was studied by the author by means of a Küstner ionization instrument. He found that with or without a cone, as well as between different types of cones, there may be a difference in the surface dose in deep therapy up to 20 per cent or higher. Three factors are responsible for these variations: (1) The

secondary irradiation of the filter; (2) the stem radiation, and (3) the absorption in the wooden bottom of the cone. For the practice one must conclude, therefore, that calibrations of X-ray apparatus should be carried out with the same cone attached as used during the treatment. Cones should be standardized so as to avoid appreciable variations.

ERNST A. POHLE, M.D., Ph.D.

EXPERIMENTAL STUDIES

Experimental Studies Concerning the Problem of Secondary Radium Rays. J. Suetsugu. *Strahlentherapie*, 1931, XL, 401-426.

The author studied the effect of secondary radium and roentgen rays on cultures of *B. prodigiosus*, ascaris eggs, and photographic emulsion. Pertinax, aluminum, copper, silver, and lead were used as secondary radiators. The experimental set-up is described in detail. It appeared that for secondary radium rays there was a remarkable agreement between the biologic experiments done on bacterial cultures and on the photographic emulsion. The results obtained on bacteria and on ascaris eggs were also in good agreement in contrast with the same experiments conducted with secondary roentgen rays. The agreement in the case of secondary radium irradiation is explained by the fact that it has a higher penetration and is not, as the secondary electrons produced by roentgen rays, already absorbed in the upper layer of the absorbing material. The differences in the quantitative relations are probably due to the difference in the absorption laws for roentgen and gamma rays of radium. The dependence of the secondary irradiation from the atomic number was much less pronounced with gamma rays than with roentgen rays. Marked discrepancies appeared also between the entering radiation and the outcoming radiation. The secondary radiation on the exit side of the absorbing layer reaches a minimum for metals of medium atomic number.

In the physical experiments this was found if tin served as a secondary radiator. The maximum amount of secondary rays is produced by lead; the materials with lower

atomic number, as, for instance, pertinax, produce only slightly less secondary radiation. Further analyses of the experimental results showed also that at the side where the radiation enters, the intensity of the secondary metal radiation is higher, while on the side where the rays leave the absorbing layer, the secondary beta rays of the organic material are more effective. For practical purposes, certain deductions may be drawn from this work, particularly as to the proper applicators for radium treatment. If, for instance, it is desirable to have a minimum of secondary rays, it would be best to place a material between radium applicator and tissue which has an atomic number in the neighborhood of that of tin. Further experiments are necessary, however, to prove this assumption.

ERNST A. POHLE, M.D., Ph.D.

Measurements of the Distribution of Heat Rays in Various Parts of the Animal Body by Means of the Photographic Method. J. Plotnikow and R. Mibayashi. *Strahlentherapie*, 1931, XL, 546-561.

The authors determined quantitatively, with the photographic method, the longitudinal dispersion effect (Plotnikow) in liver, skin, muscles, and other tissue. In certain organs, the dispersion was so high that the entering light rays were partially returned through the entering surface. This shows that a transparency of the body for light can not only be caused by reflection and absorption but also by a complete inner dispersion. The significance of these findings for certain medical problems is discussed.

ERNST A. POHLE, M.D., Ph.D.

THE FOOT

The Weak Foot. W. H. Daniels. *United States Vet. Bureau Med. Bull.*, March, 1931, VII, 246-249.

In a discussion of the normal anatomy and mechanism of the foot, the author considers that weight-bearing is accomplished by a series of arches formed by the tarsal and metatarsal bones which are strengthened by the

ligaments and tendons of the foot. The medial and lateral anteroposterior arches are the main supports. The medial arch is made up of the os calcis, astragalus, scaphoid, the three cuneiforms, and the first, second, and third metatarsals. The lateral arch is composed of the os calcis, cuboid, and fourth and fifth metatarsals.

The principal causes of pes planus in children are infantile paralysis and genu valgum. In adults this condition is found frequently in those occupations requiring constant weight-bearing. Poorly shaped shoes which hold the front part of the foot in the everted position, thus causing a constant strain on the plantar fascia and ligaments, are the principal cause of pes planus.

In severe cases the external malleolus becomes flattened and rounded and the astragalus is dropped from its normal position above the os calcis to the inside of this bone. Changes are also noted in the os calcis, scaphoid, and cuboid. The scaphoid and cuboid are later displaced, resulting in the loss of the normal play of the foot.

The most important symptoms are pain, distortion, tenderness, and spasm of the foot. The gait of the patient suffering from weak foot is characteristic, as he shuffles along with his feet everted. The author advises having the patient stand on a cardboard blackened with camphor smoke to determine weight-bearing. X-ray examination will show the relationship of the bones to each other.

The treatment depends on the kind and severity of the case and includes adhesive plaster straps, contrast baths, exercise, proper shoes, arch supports, and, in extreme cases, plaster casts.

J. N. ANÉ, M.D.

GALL BLADDER (NORMAL AND PATHOLOGICAL)

An Improved Method for Oral Cholecystography. Carl Sandström. *Acta Radiologica*, 1931, XII, Fasc. 1, No. 65, pp. 8-22.

The Maria Hospital, Stockholm, employs

oral cholecystography exclusively. The author attributes their excellent results to (1) their radiographic technic and (2) an improved method of giving the dye.

Sandström advocates making films in various positions, using compression technic, such as Åkerlund employs in examination of the duodenal bulb, also fluoroscopic observation to ascertain the mobility of the gall bladder and the presence of tenderness on pressure. An enema is given immediately before the first films are made.

The author, upon attempting to determine whether the cause was imperfect absorption of the dye or a pathologic gall bladder, describes difficulties met with in patients with poor gall-bladder shadows. Small non-opaque stones may not be visible in a poorly filled gall bladder.

It is known that the iodine salt used in cholecystography is eliminated from the body slowly and that it is re-absorbed by the intestine after evacuation from the gall bladder. Sandström makes use of this fact by giving his patients repeated doses of the dye on successive days instead of one massive dose.

Three methods of divided administration are described.

(1) At bedtime the patient takes one-half the usual dose of dye (1.5 to 2 grams) in alkaline, carbonated mineral water. During the following day he eats small meals and avoids gas-forming carbohydrates. The last meal of the day, a very small one, must contain no fats or egg yolks, and should be taken about 5 P. M. At 9 P. M. the patient takes a full dose of dye (3-4 grams). The next morning the roentgen examination is begun. This is the method which is preferred in the Maria Hospital.

(2) Late in the evening the patient takes 1.5 to 2 grams of dye. At breakfast the next morning he again takes 1.5 to 2 grams. The evening meal must be very light and is taken about 5 o'clock. At 9 P. M. the patient receives 1.5 to 2 grams of dye. The roentgen examination is made as usual on the following day.

(3) The patient has a small meal at 5 P. M., and at 9 P. M. he takes from 3 to 4 grams of dye. The following morning, films

are made of the gall-bladder region. If the gall bladder is well filled or definite stones are seen, the examination is continued the same day in the ordinary way. However, if no gall-bladder shadow is seen or if a poor one is evident, the patient is allowed his meals during the day, takes his last food at 5 P. M., and at 9 P. M. has another full dose of dye. On the following day, the X-ray studies are completed as usual. This method has the advantage of consuming less time, if the first dose is sufficient, and of serving as a check-up in cases of poor filling or no shadow. On the second morning the author has often seen a normal gall-bladder shadow in persons who presented no visible shadow the first day.

The best shadows, in the divided dose method, are usually obtained 12 hours after the last dye is taken.

The advantages of this method of cholecystography are as follows:

(1) Normal patients show denser gall-bladder shadows with much less variation of concentration than when the ordinary one-dose method is used.

(2) Many patients who give no visible gall-bladder shadow with the usual technic have shown satisfactory filling with divided doses of dye.

(3) Reactions are milder than with single large doses of dye. Only 17 per cent of cases present mild nausea; 73 per cent have no symptoms at all. Only those patients with high grade cholecystitis have vomited.

The author has used this method as a control test in 53 cases that have had previous examinations by the one-dose technic. Thirty-one of these patients showed no shadow with the single dose, and 22 had a very poor filling. Nine of the no-shadow cases, when examined by the new method, had normal gall bladders; 6 had good filling and definite evidence of stones; 2 had persistent poor filling, and 14 again failed to show any visible gall-bladder shadow. Of the cases with poor shadows at the first examination, 9 showed normal gall bladders when re-examined; 7 showed definite gall-bladder shadows with stones; 1 showed a well-filled gall bladder, with constriction of the body, and 5 continued to exhibit poor filling.

The divided dose method has been used in 152 cases: 51 of these patients have come to operation. The roentgen diagnosis has been confirmed in all but two of them. One of these patients, who had no gall-bladder shadow by cholecystography, was found to have a normal gall bladder, but there was a large tumor of the adrenal which displaced the liver. The other patient also showed no filling of the gall bladder at two cholecystographies, but at both examinations he was drunk. At operation he was found to have a normal gall bladder but definite pathologic changes in the liver.

The author regards the divided dose method of oral cholecystography as entirely comparable to the intravenous method in reliability. He stresses that from his experience he believes the dye to be better given in alkaline, carbonated mineral water than in any other medium he has tried.

A. L. HART, M.D.

Gall-bladder Visualization and Jaundice.
E. L. Walsh and A. C. Ivy. *Proc. Soc. Exper. Biol. and Med.*, January, 1931, XXVIII, 382.

The authors demonstrated that in obstructive jaundice in dogs the gall bladder was slow to visualize after the administration of tetraiodophenolphthalein, and the usual density of the shadow was decreased. They ligated the common bile ducts of five normal dogs, and from 60 to 96 hours later the dye was injected. The gall-bladder shadows became faintly visible in from 14 to 50 hours. While some slight increase in density was observed later, the "normal density" was not noted at any time.

They also confirmed the findings of Copher, showing that the disappearance of the gall-bladder shadow, following a fatty meal, was accomplished by the exit of most of the gall-bladder contents through the biliary passages. After visualizing the gall bladders of five dogs by means of the dye, the common bile ducts were ligated and fatty meals were fed to the animals daily. The gall-bladder shadow be-

came more dense after two or three days and the density persisted for two weeks, after which time further observations were not made.

J. N. ANÉ, M.D.

Uroselectan: A Radiological and Urological Study. Bransford Lewis, Grayson Carroll, and Martyn Schattyn. *Southern Med. Jour.*, March, 1931, XXIV, 206-210.

Cystoscopic urography is not always practical and the method of examination by uroselectan is supplementary. Each method of examination has its place. The cystoscopic technic gives roentgenograms which are superior to those following the administration of uroselectan. The evidence is positive while that of uroselectan is negative. In the method, the patient drinks freely of fluids the day before the injection, and the intestines must be as free from contents as possible. A "flat" roentgenogram is taken before the injection. The technic advised by the authors of this method is followed, except that the time is reduced to ten minutes. From three to five roentgenograms are taken, according to the requirements of the case. It has been shown that normally, 90 per cent of the uroselectan injected is eliminated by the kidneys, 60 per cent in the first two hours, 25 per cent in the next hour, and the remainder in the next four hours, which facts may be utilized in making roentgenograms. A child of seven years receives one-half, and one of two years, one-fourth the adult dose. There is no object in dividing the dose between the two arms as suggested by some authors. Six cases are cited.

W. W. WATKINS, M.D.

Gaseous Pericholecystitis with Cholecystitis and Cholelithiasis. C. F. Hegner. *Arch. Surg.*, June, 1931, XXII, 993.

The author reports the case of a man, 62 years of age, suffering from an acute gall-bladder attack. Cholecystography was done and resulted in none of the dye being seen in the gall bladder, but that organ was seen to be distended with gas, which increased

very markedly in the next two days. At operation, the gall bladder was found to be much distended with gas. There were many adhesions around this area, and a number of small abscesses in the wall. Because of difficulty from bleeding, a drainage was done, this being followed by death several days later.

At autopsy, the gall bladder was found to be perforated by a calculus and it contained other calculi as well. A specimen of the blood around the tumor mass after the surrounding adhesions were separated showed a pure culture of an atypical Welch's bacillus. Various cocci were also found.

HOWARD P. DOUB, M.D.

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Radiologic Examination of the Stomach after Gastro-enterostomy. René A. Gutmann. *Bull. et Mém. de la Soc. de Radiol. Méd. de France*, February, 1931, XIX, 58.

Many diverse lesions are present and may be demonstrated by giving a small glassful of a thick barium mixture, followed by manual palpation of the stomach. Localized perigastric or generalized gastric adhesions may be noted and often stenoses of the stoma opening may be demonstrated. Frequently there is a small peptic ulcer in the stoma opening itself. Stereoscopic films may show a niche not seen at fluoroscopy.

CHARLES S. CAPP, M.D.

Fluoroscopy in Gastro-intestinal Diseases. Edwin Boros. *Med. Jour. and Rec.*, Dec. 3, 1930, CXXXII, 551-553.

The majority of clinics abroad subscribe to the dominance of fluoroscopy in gastro-intestinal X-ray examination, and the taking of films is added only in borderline cases, or to preserve records. In this country, while fluoroscopy is done routinely, it does not seem to the author that it has the prominence it deserves. In fluoroscopy, the patient should

be examined in the erect, recumbent, and lateral positions, the latter especially for adhesions about the stomach. The chest should be included in every gastro-intestinal examination. Fluoroscopy, though regarded as of primary importance, should be supplemented by films.

W. W. WATKINS, M.D.

The Reflex Influence of the Colon, Appendix, and Gall Bladder on the Stomach. F. M. Smith and G. H. Miller. *Archiv. Int. Med.*, December, 1930, XLVI, 988-993.

Distention of the colon and introduction of croton oil into the colon or appendix caused marked increase in tone and peristaltic action of the stomach, which frequently became violent and occasionally reversed. Atropine abolished this effect; barbital anesthesia had no influence. Identical results were produced by the same chemical irritation of the gall bladder, while manipulation alone had no effect. In a patient comparable results were obtained by distention of the colon, which elicited also typical epigastric distress.

The paper, which refers to previous publications and statements of other authors who are of different opinion on the subject, illustrates the intimate interrelationship of the different organs of the digestive apparatus, which is of such great clinical importance.

H. A. JARRE, M.D.

Sympathectomy for Megalocolon. D. E. Robertson. *Can. Med. Assn. Jour.*, March, 1931, XXIV, 359.

This is a report of three cases of megalocolon, a condition which is congenital in origin, sometimes known as Hirschsprung's disease. These cases were treated by interference with the lumbar sympathetic trunk, following the work of Wade, Judd, and others.

The condition is characterized by marked constipation and great dilatation of the whole colon, from the cecum to the pelvirectal sphincter. The caliber of the colon is five times the width of the sphincter, while the walls of the colon are four times the thick-

ness of the sphincter. A destructive lesion of the nerve ganglia at the pelvirectal sphincter acts as a direct obstacle to the descending peristaltic waves and is the cause of the subsequent dilatation and hypertrophy which ensues above. Inasmuch as it has been demonstrated that *some* of the large bowel sphincters are controlled by the lumbar portion of the sympathetic nervous system, it is fair to assume that *all* of the large bowel sphincters are so controlled. Hence, if the lumbar segments of the sympathetics were severed, it might be expected that the contraction of the pelvirectal sphincter would be released and the colon be permitted to resume its normal function. As a matter of fact, this is what actually did happen subsequent to operation, and the operation of left lumbar ramisection has been demonstrated to be a cure for megalocolon.

The three cases which are reported are well illustrated by reproductions of X-ray films, showing the colon before and after the operation. The operation is described in detail and the subsequent history closely followed.

In two of the cases there was a relapse, which, however, yielded to a course of frequently repeated enemas.

In a footnote, three cases are reported by the author as having been successfully operated on since the paper was written.

L. J. CARTER, M.D.

Gastric Hemorrhage Due to Familial Telangiectasis. L. Napoleon Boston. *Am. Jour. Med. Sci.*, December, 1930, CLXXX, 798.

The author reports three cases of gastric hemorrhage due to familial telangiectasis. These patients had telangiectasis of the skin and mucosa, as well as recurrent hemorrhages from both the stomach and the rectum. In each instance, the history indicated other members of the same family or near relatives who had experienced similar attacks of bleeding from mucous surfaces.

Characteristics of this condition are as follows: (1) Blood-clotting time is within normal limits; (2) blood platelets number from 250,000 to 400,000; (3) secondary anemia is

present; (4) patients recover rapidly following seemingly large hemorrhages; (5) patients do not bleed extraordinarily after surgical operations; (6) other symptoms suggestive of gastric lesions are absent.

In spite of the fact that the patients had been victims of recurrent gastric hemorrhage since early life, each lived to be over fifty years of age.

The tendency to familial hemorrhage is transmitted by both maternal and paternal parents to the offspring.

ROE J. MAIER, M.D.

Conditions Commonly Called Colitis. J. Arnold Bagen. *Am. Jour. Roentgenol. and Rad. Ther.*, March, 1931, XXV, 308-313.

The syndrome of mucus in the stools, with intestinal irritability, is considered by the author ordinarily to indicate some abnormality of the general body state; hence some term such as "irritable colon" is preferred to "mucous colitis" or "spastic colitis," the term "colitis" being reserved for true infectious diseases of the colon, such as chronic ulcerative colitis, amebic colitis, bacillary dysentery, and tuberculous colitis. Too often, "colitis" is diagnosed, and an organic disease thereby suggested when psychotherapy will prove much more effective in controlling the symptoms than vaccines, medicated enemas, or intestinal douches.

Of the 200 cases at the Mayo Clinic, where a previous diagnosis of colitis had been made, all had definite symptoms of neurosis, many giving a history of nervous strain, excessive physical or mental effort, family difficulties, or excessive use of tobacco or alcoholics. Teachers, preachers, lawyers, salesmen, draftsmen, and merchants constituted a large percentage of this group, with 58 per cent being women and 42 per cent men.

Three groups were recognized: (1) those with loose, frequent stools; (2) those with obstinate constipation, and (3) a small group with organic lesions. Common symptoms were: generalized abdominal discomfort, particularly in the left side, occasional sharp cramp-like pains; bloating, and the passage of mucus, varying from flecks to large tubular

casts. These symptoms were often associated with numerous complaints in other parts of the body.

Proctoscopic examination revealed normal mucosa in all cases, with repeated stool examinations being entirely negative in 90 per cent of the cases, and in the remaining 10 per cent such parasites of questionable clinical significance as *Endameba coli*, *Chilomastix mesnili*, and *Endolima nana* being usually found.

Roentgenologic studies of these patients revealed diverticulosis in only 4 per cent of the cases. The barium enema examination is considered more valuable for the analysis of this group of patients than the opaque meal, which is only occasionally used.

J. E. HABBE, M.D.

Leukoplakia of the Stomach: Report of a Case. Harry A. Singer. *Archiv. Path.*, March, 1930, IX, 676-682.

The author has found only one other case reported in the literature, but squamous epithelium has often been noted microscopically in the stomach. The patient, a male, 51 years of age, presented an X-ray appearance of an hour-glass constriction and canalization of the middle portion of the stomach. There was marked gastric stasis. The roentgenologist diagnosed probable carcinoma and suggested the possibility of syphilis, the patient revealing both a four plus positive Wassermann and a Kahn. Upon resection of the diseased portion of the stomach, a 2 cm. area of leukoplakia was found, at the anterior wall of the proximal end of the specimen.

A. O. HAMPTON, M.D.

Diagnosis and Treatment of Acute Intestinal Obstruction. José Mendonca. *Surg., Gynec. and Obst.*, June, 1931, LII, 1115-1120.

Acute intestinal obstructions are divided in two classes: dynamic, and mechanical, the former being caused by trauma or paralysis. A great deal of stress is placed on the patient's history, in his own words, in differentiating dynamic from mechanical obstruction, and, in most cases, one examination alone is not sufficient.

The author stresses the necessity of careful physical examination and makes the following statement:

"The latest advances in roentgenography make it possible, in almost all the cases, to obtain data to confirm the diagnosis." However, he does not state to what advances he refers. Morphine is advocated with the patient in collapse from violent pain or from intestinal paralysis caused by renal or hepatic colic.

A tabulation of differential diagnosis of the dynamic and mechanical types of ileus is given. Dynamic ileus is surgical only when the intoxication is so advanced that drainage is absolutely necessary, or when the condition that caused the ileus calls for operation, while in cases of mechanical obstruction, in which enemas have failed to restore the permeability of the intestine, early laparotomy is urged. Supportive treatment is also advocated.

D. S. CHILDS, M.D.

Pathology of the Lower Colon. Rudolf Pohl. *Röntgenpraxis*, April 15, 1931, III, 337-345.

Three unusual cases of interest are described. The first case is a large myoma of the rectum which could be shown plainly by a barium enema. The author has not found similar roentgenograms in the literature. The prognosis appears dubious in such cases, as malignant degeneration very often takes place. One and one-half years after an operation the patient died as the result of a sarcomatous recurrence.

A very large fecalith was found by roentgenologic examination in a two and one-half-year-old boy who was markedly constipated. Physical examination showed a large mass in the lower abdomen, with rigidity. The barium flowed around this large mass in the rectosigmoidal region, and an X-ray film showed incrustation of the tumor with calcium salts.

The diagnosis of diverticulitis leading to a definite stenosis in the sigmoid is discussed in the third case. The roentgenologic appear-

ance of the mucosa surrounding the stenosis is of great importance in the diagnosis between benign and malignant stenosis. Re-examination after medical treatment usually shows definite improvement and excludes malignancy.

H. W. HEFKE, M.D.

Syphilis of the Stomach Simulating Carcinoma. George Bell and A. H. Tebbutt. *Med. Jour. Australia*, Jan. 17, 1931, I, 81. (Reprinted by permission from *British Med. Jour.*, May 9, 1931, No. 3670, p. 86 of *Epitome of Current Medical Literature*.)

The authors report the case of a naval stoker, aged 37, who complained of dull aching pain over the epigastrium, and sickness soon after food. The duration of the illness was six months, and there was no history of venereal disease. He had lost weight, and his bowels were constipated and irregular. There was tenderness over the pyloric area but no palpable mass.

An X-ray examination revealed a subtotal pyloric obstruction and a large filling defect of the pylorus, which suggested malignant disease. A fractional test meal showed a fasting residue consisting of 200 c.c. of bile-stained fluid, with much muco-pus and no acid. Occult blood was present. After a test breakfast there was neither hydrochloric nor lactic acid. The stomach did not empty in three hours. Malignant disease of the pyloric end of the stomach was diagnosed, but the Wassermann test gave a strongly positive reaction.

The patient was given intensive antisyphilitic treatment for three weeks, and was then submitted to laparotomy. The pyloric end of the stomach, which was found to be infiltrated and thickened, was resected and a gastroenterostomy was performed. Recovery was uneventful. Macroscopic and microscopic examinations showed erosion of the mucosa not involving the muscularis. There was marked infiltration of the submucosa by round cells, plasma cells, endothelial cells, and eosinophils. In the muscularis and the submucosa were found giant-cell systems typical of tubercu-

losis. Marked obliterative endarteritis was found in several vessels.

Studies on the Stereoscopic Demonstration of the Gastro-intestinal Tract on the Basis of the Mucosa Technic. Roeck. *Röntgenpraxis*, May 1, 1931, III, 395.

Stereoscopic films of the gastro-intestinal tract are of enough value, compared with the ordinary technic, to warrant further trials. The patient drinks a small amount of a thin barium mixture under the fluoroscope. By turning the patient to the right, then to the left, and again on his back, a filling of the duodenum is accomplished in most cases. A very fast technic must be used in order to prohibit motion, one-twentieth of a second being used (from 160 to 200 ma.) for the exposure. The time for shifting the apparatus and changing the films is given as one-half second. The anterior and posterior wall of the stomach may be easily differentiated by stereoscopic examination.

H. W. HEFKE, M.D.

GASTRO-INTESTINAL TRACT (THERAPY)

The Treatment of Peptic Ulcer. I. W. Held and A. Allen Goldbloom. *Can. Med. Assn. Jour.*, March, 1931, XXIV, 372.

There is no specific medical treatment of peptic ulcer at present, certainly none based on pathogenesis and etiology.

Therapeutic measures should be adapted to the condition of the ulcer. But the difficulty is that no method, not even the X-ray, can determine in every case exactly the condition of the ulcer. Cases have been met in which the most exact X-ray studies have revealed no evidence of ulcer, and yet hemorrhage or perforation has developed within a week. On the other hand, cases with a distinct deformity of the stomach or duodenum, with even a large niche suggestive of begin-

ning malignancy, improve rapidly under medical treatment, so that, roentgenologically, the niche is seen to become smaller or disappear.

The first consideration in the treatment of non-bleeding or non-perforating ulcer is the obtaining of rest of body. At present the majority of authors advocate ambulatory treatment, having in view the economic advantage to the patient. The authors regard this as a mistaken point of view. By not insisting that the patient go to bed, we allow the ulcer to develop and encourage serious complications, at times doing more by our care not to injure the economic condition than if we had advised bed treatment for two or three weeks.

Coincident with rest of body, we must try to reduce to a minimum the most important gastric functions, namely, secretion and motility. In order to do this, we must understand what articles of diet will least tax gastric secretion and motility and yet be nutritious enough. Today we have complete information on the effect of the various foods on gastric secretion through the work of Rehfuess and his pupils, while the work of the pupils of Von Bergmann has furnished roentgenological evidence of the influence of food on gastric motility. From these two standpoints the authors discuss the action of such foods as milk, carbohydrates, fat, proteins, vegetables, fruit juices, soups, and condiments.

Alkaline medication is given for the relief of epigastric distress only when specially indicated. The patient is impressed with the fact that the dietetic is the main treatment.

In the treatment of hemorrhage complicating peptic ulcer, rest in bed and the withholding of all food by the mouth during the acute stage are imperative. The usual treatment of hemorrhage should be employed, as morphine, adrenalin, glucose, blood transfusion, and so forth.

In the treatment of callous and stenosing ulcers, one must be very careful to rule out spasm, as this may simulate organic changes very closely. If organic stenosis can be determined, medical treatment should be employed only with a great deal of apprehension, and only when either the age of the individual or

some co-existing constitutional disease makes operative procedure fraught with danger.

The penetrating ulcer is indicated by the existence of a niche which will, in most cases, yield to medical treatment of the most rigid type. The passage of the stomach tube is interdicted. The results of treatment should not be judged by the disappearance of the niche, for it may disappear and the ulcer remain. The patient's subjective improvement is the only criterion of the cure of the ulcer.

The authors refer to the treatment by X-rays, stating that in a personal communication from Dr. I. Seth Hirsch he informs them that he has obtained good results from this type of treatment.

The indications for surgery may be classed as relative and absolute. The relative indications are as follows: The patient's economic condition, the recurrence of symptoms, disturbances of motility from persistent hypersecretion, a niche 3 or 4 centimeters in circumference, marked delay in the emptying time of the stomach, and gastric hemorrhage. The absolute indications for surgery are as follows: Occult bleeding, epigastric pain with evidences of collapse, acute perforation, third degree pyloric stenosis or organic hour-glass contraction, marked adhesions to adjacent organs, and chronic appendicitis or gall-bladder disease.

L. J. CARTER, M.D.

GENITO-URINARY TRACT (DIAGNOSIS)

A Study of Vesicorenal Reflexes and of the Possibility of a Renorenal Reflex. James I. Farrell. *Jour. Urol.*, May, 1931, XXV, 487-496.

Summarizing this very interesting article, the author finds that both distention of the bladder and stimulation of the pelvic nerve produce a change in the renal volume and inhibition of the urinary flow, which may be partial or complete. When the splanchnic nerve is sectioned, however, distention of the bladder or stimulation of the pelvic nerve has no effect upon the urinary flow. Stimulation

of the hypogastric nerve also fails to alter it. Distention of the renal pelvis on one side causes an inhibition of the urinary flow and a vasoconstriction of the vessels of the opposite kidney. This is manifested by a reduction in renal volume, which can be greatly magnified by the injection of a diuretic, such as glucose, immediately preceding the distention of the renal pelvis.

During the active stage of micturition, no urine flows from the ureters. This appears to be a protective mechanism to prevent back-pressure on the kidney.

In conclusion, the author presents the following facts:

1. That the bladder receives afferent nerves capable of giving rise to sensation is well known, and many of these impulses traverse the pelvic nerve. In addition, the presence of efferent fibers in the splanchnic nerve to the kidney has been demonstrated. Most of these efferent fibers are, in all probability, vasomotor in character. That a reflex relation exists between the bladder and kidneys is demonstrated by the experiments which showed that the urinary flow was inhibited by stimulation of the pelvic nerve, except after section of the splanchnic nerve.

2. When distention of the bladder is present, urinary flow is diminished, this being, in all probability, a protective mechanism to prevent pressure within the renal pelvis. Clinically, in urinary retention, when the bladder is chronically distended, this reflex is apparently destroyed, since in many of these cases hydro-ureter and hydro-nephrosis develop. In this connection, the absence of a flow of urine from the ureters during micturition is interesting. This is, no doubt, due to contraction of the ureters in order to prevent back-flow of urine.

3. Reflex inhibition of urinary secretion has been observed, following operations on the kidney and other organs; and, experimentally, distention of one renal pelvis produces pain, a decrease in the blood pressure, and inhibition of the urinary flow on the opposite side. While it is probable that this inhibition is the result of vasomotor changes within the kidney, nevertheless the experiments clearly demon-

strate that it is possible to influence the urinary secretion of one kidney by distending the pelvis of the opposite kidney. If this interpretation is correct, it would serve to substantiate the existence of a renorenal reflex.

DAVIS H. PARDOLL, M.D.

Radiography during Operation for Renal Calculus. R. J. Willan. *Brit. Med. Jour.*, Oct. 4, 1930, II, 552, 553.

The author, in attempting to decide whether the so-called recurrent renal calculus was really a recurrence or whether it was a case of a stone or a fragment of a stone being left behind, after radiating a large series of exposed kidneys which were either known to contain calculi or suspected of doing so, which did not show up in an ordinary radiogram, has come to the following conclusions:

1. Radiotherapy of an exposed kidney is helpful in guarding against the recurrence of a stone, and should be a routine procedure in all nephrolithotomy operations.

2. Detection of the exact site of a renal calculus by radiography is invaluable in preventing the needless sacrifice of renal tissue.

The technic of the procedure is outlined, in which the film in its paper cover, wrapped in sterile gauze, is pushed down into the wound so that it lies under the kidney, after all bleeding points have been sutured, and the exposure is made. The technical difficulties here are less than in screening the exposed kidney, where small calculi are apt to be missed. After a calculus has been located and removed, a further film is made to exclude the possibility of fragments being left behind, which could become the nuclei from which further stones might develop.

Illustrative cases are recorded, demonstrating the several advantages offered by taking X-ray films during the operation of nephrolithotomy.

W. D. MACKENZIE, M.D.

Calcification of Intrarenal Arteries, Giving Roentgen Appearance of Calculi. George Winthrop Fish and Leonard A. Hal-

lock. *Jour. Am. Med. Assn.*, June 6, 1931, XCVI, 1935, 1936.

Calcification of the walls of the large intrarenal branches of the renal arteries, in such a way as to give the roentgenologic appearance of calculi or tuberculous calcification, is extremely rare. No reports of a similar case were found in the literature. Roentgen examination showed numerous shadows which were thought to be small calculi or calcifications, due to tuberculosis in the kidney.

The patient died of carcinoma of the bronchus later, and necropsy revealed large palpable and visible plaques of calcium in the walls of the renal arteries.

Such shadows associated with hematuria might be diagnosed as renal calculi. The results of operation, when performed, have proven unsatisfactory.

C. G. SUTHERLAND, M.D.

Recurrent Renal Calculus: Its Cause and Prevention. Robert H. Herbst. *Am. Jour. Surg.*, April, 1931, XII, 58-62.

After conservative operations for its removal, renal stone recurs in over 15 per cent of the cases. These may be divided into two groups: the true and the false. The latter is by far the most frequent.

Undoubtedly, one of the most important factors in the recurrence of renal calculi is the failure to remove all stones or fragments. Even in cases which have been subjected to a most careful pre-operative roentgenologic study, stones are very apt to be overlooked for the following reasons:

- (1) They may fail to produce shadows on films taken with the kidney in the body.

- (2) Two or more stones may be superimposed on one another, producing one shadow.

- (3) When a stone is removed, especially with instruments, a small piece or pieces may be broken off or left behind, and promptly cause a recurrence.

- (4) They may be seen on the film but not found at operation.

Practically all of these conditions may be avoided by fluoroscopy of the exposed kidney before its replacement, as described by

Braasch; or, better still, by placing a small film behind the delivered kidney and exposing it to the X-ray, as described by Quimby. This small film, in all probability, will show any stone or fragments which have been overlooked and will help in locating those which have eluded the operator. If this method is carried out routinely, the cases of recurrent renal calculi will be greatly reduced. The use of these methods is not a refinement but an absolute necessity in the surgery of renal calculi.

DAVIS H. PARDOLL, M.D.

GENITO-URINARY TRACT (THERAPY)

Roentgen Therapy of Uterine Myoma. Martius. Schweiz. med. Wchnschr., April 25, 1931, LXI, 408.

The following types should be irradiated: (1) Elderly women; (2) hypermenorrhea near the climacteric; (3) young women in whom there exists a contra-indication to operation.

The author uses four fields, 8×6 cm. in size, 2 antero-posterior and 2 postero-anterior, giving a 34 per cent center dose. This necessitates the application of from 350 to 450 r to each field.

H. C. OCHSNER, M.D.

Radium Therapy of Tumors of the Genito-urinary Tract. B. S. Barringer. Am. Jour. Surg., May, 1931, XII, 243-248.

An analysis is made of the effect of radium therapy upon the treatment, prognosis, and general conception of the control of carcinoma of the penis, teratoma of the testis, carcinoma of the prostate, and cancer of the bladder.

From his vast experience with these conditions, the author staunchly advocates the use of radium and deep X-ray in carcinoma of the genito-urinary tract.

1. *Carcinoma of the Penis.*—When the carcinoma is papillary and infiltrating in type, and if Buck's fascia has been penetrated but a slight distance, then operation may be entirely eliminated and the carcinoma controlled by radium, which, as a rule, is applied to the surface. If the infiltration is extensive, excision of the penis 2 cm. beyond the growth should

be done, with immediate dissection of the excised portion, in order to accurately determine the border of the growth. No routine inguinal dissection is performed. Deep X-ray therapy and radium pack, with implantation of radium in any suspicious glands, is the procedure employed.

Primary lesions confined to the foreskin are removed by circumcision, and any suspicious areas remaining are irradiated. If the primary lesion is 2 cm. or less in diameter, superficial, and if metastases cannot be detected, external irradiation alone is used. The tumor is treated with a radium pack, the dose being 1,200 mc.-hrs. per sq. cm., at 1 cm. distance. Of 13 patients in this group, 92 per cent are living without signs of disease. The period of observation varies from eighteen months to nine years, four months.

When deep penetration by the tumor has occurred, preliminary irradiation is followed by conservative amputation. Four patients were treated in this manner, all of whom are alive and well from two to seven years following the operation. If the primary tumor is larger than 2 cm. in diameter and metastases are not found, the treatment of choice is usually irradiation, followed by conservative amputation in from three to four weeks. In extensive tumors with considerable destruction, amputation is performed without pre-operative irradiation. Of 66 patients, 57.5 per cent are alive and, so far as can be determined, free from disease. There has been no operative mortality.

2. *Teratoma of the Testis.*—Brilliant results accompany this form of tumor when radiation is employed. In the primary cases, in which no surgery has been done, the testis is thoroughly irradiated with the radium pack. Deep X-ray therapy and the radium pack are also applied to the course of the spermatic vessels on the side affected. Two months later the testis is removed under local anesthesia, the cord having first been cut. No mortality accompanies this procedure. Of 113 cases, 41 are living and clinically free of disease. The period of observation ranges from twelve months to ten years.

3. *Carcinoma of the Prostate.*—Early di-

agnosis is of prime importance in this disease. Because a certain percentage of prostatic carcinoma is highly malignant and radio-sensitive, a thorough cycle of deep X-ray radiation, using five portals of entry, should be utilized prior to any other procedure. This, at best, gives only about one and a half erythema doses to the prostate. The author believes that somewhere between ten and fifteen are necessary to control the large majority of prostatic carcinomas. Cystotomy should be employed, any obstructive portions of the prostate removed with cutting forceps or a cautery, and the entire tumor, periprostata, periprostatic region, and seminal vesicles, if they are involved, implanted with radium seeds of 2 mc. each to every centimeter of tumor. The mortality of this operation is not so great as that of Young's radical removal, and the effectiveness of this method in controlling prostatic carcinoma will in time be demonstrable.

4. *Cancer of the Bladder*.—In this condition surgery and radium still continue to be contestants for honors. The reason for so many failures in cases in which radiation had been employed has been insufficient dosage. Ten times an erythema dose is necessary to control the radioresistant tumors. This accounts for the failure of deep X-ray, for the maximum obtainable by this method is not much more than one and a half erythema doses.

In doing suprapubic implantation, spinal anesthesia should be used, and the bladder should not be mobilized. The abdominal wound should be thoroughly screened with gauze before opening the bladder, great care being taken not to spill its contents over the wound. After obtaining a good exposure of the tumor, its papillary portions should be removed by some form of cautery. The radium implantation should be very accurate, and, if the bladder is dirty or the radium dose very large, a small suprapubic drainage tube (18 to 20° F.) should be left in place for about a week or longer. The bladder is not sutured to the abdominal wall. One gold seed of 2 mc.-hrs. to 1½ sq. cm. of tumor is a minimum dose. As many as forty such seeds have been used in tumors of large size.

The operative mortality of this procedure in 109 cases was 3.6 per cent compared to that of between 10 and 20 per cent in operative removal.

DAVIS H. PARDOLL, M.D.

GYNECOLOGY AND OBSTETRICS

The Therapeutic Interruption of Pregnancy by Roentgen Rays. M. Ganzoni and H. Widmer. *Strahlentherapie*, 1930, XXXVIII, 754.

This is a reply to Fürst's criticism of the use of roentgen rays to induce abortion. The authors still believe that in cases in which, at the same time, temporary or permanent sterilization is desirable, the roentgen abortion should be given the preference. Their clinical observations have been reported in two articles (*Strahlentherapie*, 1925, XIX, 485, and 1930, XXXVI, 510), dealing with 34 and 39 patients, respectively.

ERNST A. POHLE, M.D., Ph.D.

The Diagnosis of Disproportion. Herbert Thoms. *Surg., Gynec. and Obst.*, May, 1931, LII, 963-970.

The author discusses disproportion and states that this subject divides itself into two factors: the size of the fetus and pelvis. External and internal pelvimetry are discussed, and under the heading, "Summary of Pelvimetry," he concludes that the method is not only inadequate but often misleading. He believes that by the roentgenologic method accurate measurement of both the anteroposterior and transverse diameters of the superior strait can be made; and secondly, by lateral pelvigrams, the relationship of the sacral promontory and anterior surface of the sacrum to the posterior surface of the symphysis pubis may be obtained.

Roentgen pelvimetry, as described by the author, is discussed and his technic outlined, as in some of his previous communications. He says that pelvimetry of the superior strait is the more frequently used, and the lateral technic is employed only when a rachitic pelvis is suspected.

A tabulation is included, so that the biparietal diameter can be constructed from a given occipitofrontal diameter.

To quote from the summary: "It is the writer's opinion that the time has arrived when to treat doubtful cases of disproportion without proper roentgenologic examination is as culpable as to treat fractures without the aid of the same diagnostic means."

D. S. CHILDS, M.D.

X-ray Therapy in Hemorrhages of the Menopause and Uterine Fibromas. Remy-Roux. *Bull. et Mém. Soc. Radiol. Méd. France*, April, 1931, XIX, 192-195.

One thousand r-units each to four portals of entry, centering on the pelvis, are usually sufficient to stop the uterine hemorrhages of the menopause, with considerable lessening of the vertigo and insomnia. Uterine fibromas at times require 6,000 r-units, while the average case requires 2,000 r-units in from four to six divided dosage treatments.

The voltage factors are as follows: 200 K.V., 1 mm. copper and 2 mm. aluminum filter.

CHARLES S. CAPP, M.D.

The Pathologic Cervix and its Treatment. B. H. Orndoff. *Illinois Med. Jour.*, November, 1930, LVIII, 380-383.

The writer emphasizes the importance of the recognition and treatment of pathologic conditions of the cervix prior to chronic degenerative and malignant changes.

The pathologic changes discussed are as follows: cervicitis, ulceration, ectropion, and erosion. Diagnosis is to be made by palpation, inspection, and trachelograms after the use of radiopaque oils.

The writer then destroys all pathologic tissue by means of electrocoagulation.

The conclusions are as follows: (1) The importance of a pathologic cervix has been emphasized; (2) the general health is often greatly improved when the pathologic cervix is relieved by electrocoagulation; (3) the pathologic cervix may be a focus of infection;

(4) conception has occurred after coagulation when sterility previously existed; (5) recurring perineal and vulvar irritation is relieved; (6) the liability of a malignant change in the cervix after coagulation seems very small; (7) the liability of malignancy in pathologic cervices not operated upon seems very great; (8) the value of a thorough pelvic examination for women between 35 and 60 years of age cannot be overestimated.

C. H. DEWITT, M.D.

HEART AND VASCULAR SYSTEM (DIAGNOSIS)

Congenital Idiopathic Enlargement of the Heart. George W. Holmes. *Am. Jour. Roentgenol. and Rad. Ther.*, March, 1931, XXV, 320-323.

Congenital idiopathic enlargement of the heart is undoubtedly an uncommon condition, although, as the author points out, only those cases have been reported which have had autopsy proof, and it is quite possible that all do not die in early infancy. The author reports two cases, the first occurring in a female infant of seven months, in whom, clinically speaking, tumor with mediastinal compression and pulmonary infection or congenitally enlarged heart were considered as possible diagnoses. Roentgenologically, the cardiac enlargement was not suspected, because the retrocardiac space was clear and the enlargement into the left chest was obscured by associated atelectasis and pulmonary infection in the left lung. The heart at autopsy showed enlargement of all of the chambers, the weight being 175 grams (normal 34 grams). Microscopically the muscle cells were twice as large as normal. The second case was that of a baby fourteen days old who had had previous diagnosis of and treatment for enlarged thymus. When examined, he showed, on both the physical and X-ray examination, evidence of distinct enlargement of the heart to the left. In this case, the heart at autopsy weighed 50 grams, all cavities being equally dilated, there being a patent ductus arteriosus which allowed the passage of a large probe.

The author calls attention to the difficult position in which the roentgenologist may find himself in such cases as these. With findings similar to those in the second case, he might be disturbed to learn of the sudden death of the infant after a diagnosis of no thymic enlargement had been made from X-ray examination. Again, with findings similar to the first case, a large thymic tumor might be roentgenologically suspected, but the patient would certainly show no improvement under roentgen therapy, and might even die in the course of it, in which latter case death might be attributed to the treatment.

J. E. HABBE, M.D.

Functionally Two-chambered Heart. L. Minor Blackford and Lewis D. Hoppe. Am. Jour. Dis. Child., May, 1931, XLI, 1111.

The case of an infant, aged 6½ months, is reported, with clinical, roentgenographic, laboratory, and postmortem observations. The right atrium opened through the foramen primum into the left atrium, which in turn opened through the mitral valve into a single ventricle. The tricuspid valve was absent. The aortic, the pulmonic, and the bicuspid valves were normal. Extreme stenosis of the ventriculo-bulbar junction prevented the passage of an adequate amount of blood to the lungs. More detailed dissection revealed a small right ventricle in the mass of ventricular muscle. Functionally, it can be stated, the heart was two-chambered. Roentgenograms of the chest showed merely moderate increase in the size of the heart.

F. B. MANDEVILLE, M.D.

The Roentgen Diagnosis of Pericardial Diverticulum. Gösta Jansson. Acta Radiologica, 1931, XII, Fasc. 1, No. 65, pp. 50-58.

The author describes in detail a case of diverticulum of the pericardium in a fifteen-year-old girl whom he has observed since January, 1928. During all these three years she

has remained clinically well. A previous diagnosis of mediastinal tumor had been made elsewhere. Examination of the blood showed no evidences of leukemia or of any of the lymphatic tissue tumors.

At the first examination, there was in the inner portion of the right lung field a rounded shadow which was as large as a man's fist. It was sharply demarcated from the adjacent lung tissue, was of the same density as the heart shadow, and arose from the anterior mediastinum. At this time along the left border of the heart in the region of the pulmonary cone and auricular curve, an unusual prominence was also noted. At fluoroscopy, with the patient in the horizontal position, the shadow in the right chest became longer and flatter during inspiration and broader and shorter during expiration. The first diagnosis made was encapsulated exudate arising in the anterior mediastinum.

Subsequent examinations during 1928 showed no change in the chest. But early in 1930 when the patient was seen again, it was found that the mass in the right lung field had changed very little, while there was now in the region of the left hilum a shadow which presented a sharp lateral border. This shadow arose from the mediastinum, and showed pulsation. During respiration, it disclosed the same type of change of shape as the mass in the right chest. At this time it was also possible to detect a weak pulsation in the shadow in the right side.

The author discusses, at some length, Kienböck and Weiss's article on the diagnosis of pericardial diverticulum and points out similarities between his case and the cases reported by other students. There are different opinions concerning the origin of this condition. Probably there is always a fore-running adhesive pericarditis.

In 1914, only eleven cases of this condition had been reported. Kienböck and Weiss were the first to make a clinical diagnosis of pericardial diverticulum during the life of a patient, upon the basis of earlier postmortem discovery of similar conditions. This man was seen at intervals during a period of almost twenty years. In 1908, the diagnosis was sac-

cular aneurysm of the ascending aorta; in 1914, the same; in 1919, intrathoracic tumor; in 1924, saccular aneurysm of the aorta, arising in the right sinus of Valsalva; in 1927, a cystic, encapsulated, pericardial exudate, arising from a previous pericarditis.

The differential diagnosis between mediastinal tumor, diverticulum of the pericardium, and other mediastinal lesions is extraordinarily difficult. Jansson believes that the marked changes he describes in the size and shape of a diverticulum of the pericardium during respiration are due to the fact that this mass is soft and plastic and can therefore be compressed and expanded in a way impossible for a solid tumor. These changes during respiration are more easily detected if the patient is fluoroscoped in the horizontal position. The author does not believe that aneurysm would show such changes in shape during respiration. He is of the opinion that other encapsulated, fluid-containing formations in the anterior mediastinum may show similar signs on roentgen examination.

A. L. HART, M.D.

Velocity of Blood Flow in Health and Disease: Velocity of Blood Flow in Man and its Relation to Other Measurements of Circulation. H. L. Blumgart. *Medécine*, February, 1931, X, 1-75. (Reprinted by permission from *British Jour. Med.*, May 9, 1931, No. 3,670, p. 90 of *Epitome of Current Medical Literature*.)

The author discusses the work of many investigators of the speed of the blood flow in health and disease, and describes the method he has personally employed to determine this velocity. The principle of the method is the injection of radium C, the active deposit of radium, into the antecubital vein, the time of arrival in the other arm being determined by a suitable detecting device. The detection of beta and gamma radiations depends on the fact that these radiations cause ionization of any gas they traverse, and the onset of ionization in a gas is an indication of the presence of the radiation of a member of the radio-active series. By means of a cloud chamber and a

modification of the Geiger counting chamber it is possible to estimate the circulating time from the antecubital vein of one arm to the antecubital artery of the other arm, and also to make an automatic registration of the time of arrival of the active deposit in the right heart—"the arm-to-heart time." The interval between the arrival of active deposit in the right heart and the arteries about the elbow is called the "crude pulmonary circulation time." The advantages and disadvantages of the histamine method are also discussed.

Congenital Idiopathic Hypertrophy of the Heart: A Case with Unusual Family History. Howard B. Sprague, Edward F. Bland, and Paul D. White. *Am. Jour. Dis. Child.*, April, 1931, XLI, 877-886.

The authors report, with necropsy findings, a case of congenital idiopathic hypertrophy of the heart in a girl aged seven months. The weight of the heart was more than five times the normal for that age. The family history, in brief, showed probable identical congenital heart disease in a sister, probable patent ductus arteriosus in a half-sister, rheumatic heart disease in a maternal aunt, and undetermined heart disease in a great aunt. A sister of the latter had ten female children who died at early ages, in several instances from probable congenital cardiac conditions. Observations suggest the probability of an inheritance of a tendency to congenital cardiac anomaly. Roentgenograms showed marked enlargement of the cardiac shadow.

F. B. MANDEVILLE, M.D.

Electrocardiography as a Diagnostic Aid. L. J. Godbey. *United States Vet. Bureau Med. Bull.*, March, 1931, VII, 215-217.

The author discusses the value and the limitations of electrocardiography as a diagnostic agent in determining cardiac disorders. The electrocardiogram is a representation of the nerve path from auricle to ventricle in relation to direction, time, and magnitude of the muscular fibers of the heart in its cycle of contraction. While it is believed to be of value in

heart preponderance, cardiac transposition, and arrhythmia, the electrocardiographic picture is of little or no importance in murmurs or valve lesions.

The author concludes that an electrocardiogram is valuable in cardiac conditions after all other means have been employed as diagnostic aids. He believes that the history of the patient's illness is of primary importance. Inspection and palpation of the patient as a whole and of the cardiac region in particular should be made. Percussion, in the author's opinion, is of little value in this age of radiography. One must also determine by the stethoscope the character, location, transmission, and time of the murmur. With this information known, an electrocardiogram may then give another angle from which one may reach a correct conclusion.

J. N. ANÉ, M.D.

Narrowing of the Aorta at its Isthmus.
Gordon E. Hein. United States Vet. Bureau Med. Bull., March, 1931, VII, 209-211.

The author describes five cases of narrowing of the aorta at its isthmus. He believes that the diagnosis of coarctation of the aorta, proximal to the ductus arteriosus, is practically impossible, except after death, as there are present no characteristic findings. Coarctation of the aorta of the adult type, in which the obstruction is distal to the ductus arteriosus, is more easily recognized if the obstruction be extreme or complete.

The most important findings in this condition, in the opinion of the author, are as follows: (1) Signs of dilatation of the ascending aorta; (2) well-marked collateral circulation involving the branches of the subclavia and the intercostal arteries, which is evident on roentgenograms by erosion of the under surfaces of the ribs; (3) weak or absent pulsations in the abdominal aorta, femorals, popliteals, and dorsalis pedis pulses, in contradistinction to marked pulsations in the carotids, and a well-marked pulse in the radials; (4) difference in the blood pressure in the arms and legs; (5) other phenomena of less importance, such as enlargement of the

heart without obvious cause; unexplained arterial hypertension; the presence of cerebral hemorrhage in the young; weakness in the legs in a person otherwise well developed.

There was an additional group with partial obstruction in which the diagnosis could only be inferred. With the exception of demonstrating dilatation of the ascending aorta and a moderate enlargement of the heart, the roentgen ray was of no aid in these cases. Electrocardiograms were of no help, as in only two cases with extreme narrowing, left preponderance and inversion of the T-wave were present in the first lead, suggesting early right branch bundle block. This group is believed to be the most important one, as these patients have a fairly good outlook as to life.

J. N. ANÉ, M.D.

Galvanometer Tracings Obtained in a Physico-chemical Schema Simulating an Electrocardiogram, and the Influence of Membranes on These Records. Jane Sands Robb. Proc. Soc. Exper. Biol. and Med., February, 1931, XXVIII, 482.

By making and breaking of the primary current rapidly when the primary electrodes were inclosed in a gelatine-coated membrane and recording these interruptions by a string galvanometer in the secondary circuit, the author produced deflections similar to the QRS of an electrocardiogram. When the primary electrodes were inclosed in a collodion membrane, making and breaking of the primary circuit resulted in single monophasic deflections. The relation of membrane polarization to distortions of electrocardiograms is mentioned.

J. N. ANÉ, M.D.

Electrocardiographic Study of Movements of the Heart with Change of Posture. M. H. Nathanson. Proc. Soc. Exper. Biol. and Med., April, 1931, XXVIII, 766-770.

The author demonstrated that a variation occurred in the electrocardiogram when the position of the patient was changed. Electrocardiograms were made of 60 individuals

in the reclining, left lateral, and right lateral positions.

The subjects examined numbered normal individuals and cardiac patients in whom a fixed heart was improbable. The habitus of the individual and the size and displacement of the heart were given due consideration. In 55 cases, or 91 per cent, some definite electrocardiographic alterations were noted on change of position of the body. These variations were seen especially in the QRS wave, although the other waves were modified in the same direction to a lesser degree. These modifications in amplitude and direction of the QRS wave were expressed as variations in the degree of ventricular preponderance.

When the subject was turned from the reclining to the left lateral position, right preponderance was observed in 83 per cent of the cases, left preponderance in 6 per cent, and no alteration in the electrocardiogram was noted in 11 per cent. In shifting from the back to the right lateral position, 35 per cent showed right preponderance, 35 per cent left preponderance, and in 30 per cent no change from the previous record was observed.

In the change from the reclining to the left lateral position, there occurred a predominance of the electrical effects of the rotation of the heart about the longitudinal axis in the majority of cases, with an occasional predominance of the rotation of the heart about the antero-posterior axis. When these effects neutralized one another, no alteration occurred on the electrocardiogram.

J. N. ANÉ, M.D.

HODGKIN'S DISEASE

Some Bone Changes Produced by Diseases of the Hematopoietic System. J. W. Pierson. *Southern Med. Jour.*, March, 1931, XXIV, 191-195.

Of the different types of anemias, the congenital forms produce the most interesting bone changes, which are the result of chronic over-stimulation of the bone marrow. The great increase in the number of young red blood cells in the bone is accompanied by a hyperplasia, which causes the bone marrow

to swell, producing increased pressure on the cortex. The cortex becomes thin and allows the bone to expand, registering on the roentgenogram by an increase in the size of the shaft of the long bones and the depth of the flat bones. The bones appear to be more porous than normal and present a very mottled appearance. Late in the disease, when the bone marrow is replaced by new bone, striations are seen in the marrow cavity of the long bones. In leukemia, in which the bone marrow fat is largely replaced by new blood cells, the roentgenograms show areas of lessened density, giving a mottled appearance to the marrow cavity. The cortex is thinner than normal and the periosteum is elevated, giving a picture somewhat similar to that found in the anemias.

In Hodgkin's disease, striking changes in bones are sometimes found. The bones begin to change their appearance when the fibrotic stage is reached, at which time they are quite porous and give a mottled appearance. Later, areas of necrosis are represented by numerous discrete areas of lessened density scattered throughout the osseous system. At times a large area of bone destruction is found, resembling neoplasm. In Gaucher's disease, the course is chronic and various stages of bone change may be found. The replacement of the normal by abnormal cells is indicated by areas of increased density, with an increase in the diameter of the long bones, of the depth in the flat bones, and of the vertebral bodies. The periosteum is thickened and the picture may be confused with osteomyelitis (chronic).

In many of these cases, all the factors must be considered in order to make a correct differential diagnosis.

W. W. WATKINS, M.D.

Primary Isolated Lymphogranulomatosis of the Stomach. Harry A. Singer. *Arch. Surg.*, June, 1931, XXII, 1001.

Six cases of primary isolated Hodgkin's disease of the stomach are recorded in the literature, and in none of them was the diagnosis made before operation. Five of these patients recovered and remained well.

The author reports a seventh case in which roentgen examination of the stomach demonstrated a constant annular deformity of the antrum and pars media, with about 50 per cent retention in six hours, resulting in a diagnosis of carcinoma. He believes that the clinical diagnosis of isolated lymphogranulomatosis of the stomach is hardly possible in the present state of knowledge. The final diagnosis is a histologic one.

HOWARD P. DOUB, M.D.

The Etiology of Hodgkin's Disease. Editorial. Jour. Am. Med. Assn., March 28, 1931, XCVI, 1089.

A particularly important report has recently been published under the title of "The Etiology of Lymphadenoma," a summary of six years' researches, by C. C. Twort, pathologist to the Manchester Committee of Cancer. By "lymphadenoma" is meant what most American physicians usually call "Hodgkin's disease" and what Germans often designate as "lymphogranulomatosis."

The importance of the report lies in the fact that it is based on an extremely careful study by many methods on a large amount of material. After six years of special study, Twort is compelled to state that, "There appears to be no single feature which permits one to diagnose lymphadenoma with certainty." He ventures the observation, "Besides the presence of lymphadenoma giant cells and the eosinophil cells, mitosis of the various cells outside the germinal centers, in a gland free from hemorrhages, appears to be an important diagnostic point."

It was not found possible to demonstrate consistently any specific animal or vegetable parasite in the diseased tissues. An assortment of other *in vivo* and *in vitro* experiments gave absolutely barren results. Twort says that the different experimental procedures so invariably led to nothing that one might have been dealing with a true newgrowth "instead of what is generally accepted as a granuloma."

CHARLES G. SUTHERLAND, M.D.

KIDNEY

Resection of the Kidney. David M. Davis. Am. Jour. Surg., May, 1931, XII, 272-276.

Three cases are reported in which the author performed a partial resection of the kidney. He concludes that this procedure is by no means extremely difficult or particularly associated with danger. In properly selected cases he finds this method very advantageous, and it is his belief that it should be employed more frequently.

The article is accompanied by several illustrative films.

DAVIS H. PARDOLL, M.D.

Essential Hematuria in Relation to Pyelitis of the Calyx-papilla Angle. James Miller and D. H. Young. Can. Med. Assn. Jour., March, 1931, XXIV, 354.

The term "essential hematuria" signifies bleeding from the kidney, in which, after extirpation, little that is pathologic is found. It is usually unilateral.

The causative factor has been variously regarded. Some urologists think that it is an early symptom of some other disease not yet far enough advanced to be detected. But Bumpus, in a study of 150 cases at the Mayo Clinic, under observation for from 5 to 20 years, found renal disease or malignancy to develop in only 6 cases. Nephritis has been regarded as a basal cause by some authorities. Many observe that the so-called angioma of the papilla is found in association with hematuria. Some believe that infection, either in the papilla or some other portion of the kidney, is the causative factor.

More recently Ceelen has written stressing the importance of the calyx-papilla angle or fornix of the calyx in connection with essential hematuria. He states that three explanations, microscopically, for the hemorrhage are as follows: (1) Direct bleeding from the calyx veins into the pelvis through the establishment of a pyelo-venous connection; (2) perivascular ascent of the calyx hemorrhage into the kidney, with hemorrhagic infiltration of perivascular and intertubular tissue and subsequent rupture of the blood-filled lymph

spaces into the urinary tubules; (3) development of a perivascular lymphangitis, in connection with inflammatory changes in the calyx-papilla angle, with an associated phlebotic venous thrombosis and congestion hemorrhage.

Two cases are reported, in both of which pyelitis was present, and especially localized in the calyx-papilla angle.

L. J. CARTER, M.D.

Perinephritic Abscess. Harry C. Rolnick and H. J. Burstein. *Jour. Urol.*, May, 1931, XXV, 507-512.

Fifty-five cases of perinephritic abscess are reported. Fever, leukocytosis, and costovertebral or abdominal tenderness are the triad of symptoms which aid materially in the diagnosis of this condition. Previous renal disease was present in 21 patients, direct injury to the back and abdomen in two, retrocecal appendicitis with perforation was responsible for one, and metastatic origin was a factor in the remaining 31. Pyonephrosis, calculous kidney, and retrocecal appendicitis should not be confused with this condition. The mortality rate was approximately 11 per cent. Complete absence of urinary findings, in many instances, may confuse the diagnosis, particularly in the metastatic cases.

The radiographic evidence of the obliteration of the lateral border of the psoas muscle, which is considered diagnostic of perinephritic abscess, could not be demonstrated in four of the cases. In a number of the X-ray films, however, delayed excursion, elevation, and rigidity of the diaphragm were noted on the affected side.

The authors advocate puncture and aspiration as their most valuable aid in the diagnosis of this condition.

DAVIS H. PARDOLL, M.D.

The Significance of the Radiological Renal Outline. S. Gilbert Scott. *Proc. Royal Soc. Med.*, March, 1931, XXIV, 577-583.

The author presents a very interesting paper on his subject. The improvement in ra-

diologic technic and equipment has rendered exposure of the kidney shadow possible in practically every instance. Skill in interpretation, however, has not kept pace with progress in technic. Experience and co-operation with the clinician play major parts.

The intra- or extra-renal character of shadows must be ascertained. Two essential factors are: (1) Satisfactory clearance of the gastro-intestinal tract; (2) efficient abdominal compression. (Dr. Scott recommends the sugar-loaf cushion.) This compression does not restrict renal excursion but clears the field, thereby increasing the shadow values. Individual renal radiographs furnish particularly fine detail.

Information regarding solitary or ectopic kidneys may be elicited. Also, the comparative efficiency of the mate to a badly impaired kidney may be ascertained.

Recognition of three types of renal outline is suggested, namely, globular, elongated, and lobar. The terms are self-explanatory. Along with the lobular (the reversion to the early developmental type), one should suspect other congenital abnormalities.

The position of the kidneys is somewhat variable, and respiratory excursion also shows individual variability. Use is made of this factor for the localization of opacities. Absence of excursion implies fixation by adhesions due to perinephritis.

Abnormalities of size are not so easily interpreted. The development of the kidney is normally in advance of the rest of the body; therefore, in children the renal shadows appear large in proportionate size.

Hypertrophy: Uniform enlargement is usually compensatory.

Syphilis causes an increased density of the organ.

Hydronephrosis: In the early stages no changes are manifest; later, however, general enlargement and lobulation make their appearance.

Pyonephrosis is diagnosed by the detection of pus in an enlarged kidney. The shadow cast by pus is quite distinct from that of calculi.

A local bulging may indicate hydronephrosis, cyst, or newgrowth. Accessory methods of

examination are necessary to differentiate these conditions.

One seldom meets with atrophy of the kidney. The cause is either congenital or acquired, being usually a result of tuberculosis.

The most practical use to which the demonstration of the renal silhouette may be put is in cases in which nondescript ill-formed opacities are present; yet one must determine whether the opacity is within, in front of, or behind the kidney. Shadows cast by calcareous glands, gallstones, opacities in the intestines, pills, and even a pancreatic calculus or a wart on the back, etc., may mimic renal calculi.

The author depends upon the relative position of shadows in the renal area during inspiratory and expiratory excursion for his diagnosis. Two films are taken for comparison: one at full inspiration, the other at full expiration. If the opacity is extra-renal in character, its position fails to remain constant in its relation to the kidney in the excursion of the latter during inspiration and expiration. The method has proved particularly valuable in early cases of renal tuberculosis. It is also very valuable in differentiating renal stones and gallstones. He finds lateral radiography of little practical value. Increasing the density of the renal cortex is of advantage, but cannot be employed routinely in all cases. Oral administration of some preparation for this purpose will be of benefit.

In conclusion, the author states that guesswork diagnosis in radiology with reference to opacities in the renal area must be eliminated. In the discussion which followed, the following participated:

John Everidge stated that Dr. Scott's method would hardly apply in cases of perinephritis in the demonstration of calculi. Here, pyelography—direct or indirect—was advisable. Frank Jeans advocated closer co-operation between the radiologist and the surgeon. E. J. H. Roth claimed that Dr. Scott's contention did not always apply. Calcified lymph glands, adherent to the kidney, perinephric abscess, and floating calculi might confuse the diagnosis if based on the author's assumption. He advised lateral radiography. In the preparation of the patient, vegetable laxatives or two

evenings' limitation of carbohydrates, preceding the X-ray examination, were very satisfactory. Size, shape, and position of the kidney could not be accurately judged under present conditions. Better renal visualization was obtained in stout patients because of the abundance of perinephric fat which acted as a contrast medium. The radiologist's position was only contributory in rendering a diagnosis. E. W. Riches believed that the use of charcoal aided in the preparation of the patient. He cited an example pertaining to the effect of guesswork on the part of the roentgenologist. Cyril A. R. Nitch advocated the use of an opaque catheter in the localization of renal calculi. Also, stereoscopic radiography was of material assistance in dealing with shadows in the renal area. Pyelography occasionally obscured small opacities. Clifford Morson called attention to the clinical picture. H. P. Winsbury White claimed that not all cases of hydronephrosis showed enlargement or lobulation; occasionally there may even be a diminution in size. Pyelography was necessary to make the diagnosis in these cases. Jocelyn Swan claimed that opacities on the films in tuberculosis usually appeared later and were manifest only after the disease had already made some progress. He stated that absolute reliance could not be placed on the rule advocated by the author. Radiologic findings should be confirmed by further urologic examination. The President praised the value of stereoscopic and lateral roentgenograms. He found that early tuberculosis was detectable only by means of the cystoscope and confirmed by the bacteriologic findings. The radiologist and clinician should work together and not independent of each other, in order to secure the best results.

Dr. Scott closed by maintaining that to him renal localization was still of value, even if the kidney were fixed. He did not claim that his method should replace pyelography, but that it had been of the greatest diagnostic value in the detection of early tuberculosis. Stereoscopic methods in his experience were of little value, except in the examination of ureters with an opaque bougie *in situ*. That localization was infallible he had not meant to

imply. He agreed with the President that co-operation between the urologist and radiologist was of great importance.

DAVIS H. PARDOLL, M.D.

MASTOID

How shall we Evaluate the Various Manifestations of Acute Mastoiditis? Ben L. Bryant. *Laryngoscope*, November, 1930, XL, 809.

After discussing several laboratory tests, including bacteriology of material from draining ears, lumbar puncture, blood sugar, total and differential white cell count, etc., the author states: "There are many laboratory examinations which are not only useful but essential in the proper evaluation of a case of acute mastoiditis. To some of these, the years have added increasing value; some have decreased in importance. It would seem that the roentgenographic examination has, in a good many instances, held an unjustifiably high position, because, in the final analysis, its chief value seems to be in determining the state of pneumatization, and only by repeated serial plates can one hope to gain much information as to the actual degree of destruction which the interior of the mastoid has undergone."

This impression is amplified earlier in the article. He says it is an established fact that there are widely varying anatomical conditions existing in the mastoid process. There are variations, ranging from the sclerotic through the diploic and irregularly pneumatized to the extensively, ideally, regularly pneumatized mastoid process. The two mastoid processes of one individual frequently vary, although if they are of the pneumatic type they are practically always nearly identical.

A further difficulty to X-ray interpretation is brought out by the results of investigation by Knick and Witte, who found that about one-third (8) of a series of 25 patients who had suffered with otitis media in childhood had a definite restriction of pneumatization of the mastoid cells.

H. RUDISILL, JR., M.D.

MEASUREMENT OF RADIATION

Short Wave Length Radiation: Present Standards for Measuring Quantity and Quality. Francis Carter Wood. *Jour. Am. Med. Assn.*, May 23, 1931, XCVI, 1753-1757.

The exact measurement of roentgen rays is primarily of importance in therapy in order to prevent damage to the patient's skin and to estimate the maximum effect on the tissues to be treated. The quantities of radiation used in radiography are usually so small a fraction of a skin erythema dose that there is little risk of producing any damage to the skin, unless exposures are repeated at too great frequency. It is always wise to ask whether a patient has recently had an X-ray exposure. Legal responsibility will be obviated by careful inquiry. In fluoroscopy, a rough approximation of the erythema dose should be known, and the patient, as well as the operator, should be exposed for the minimum time that will permit the necessary observations. Every record sheet, either for treatment or for radiography, should record former radium treatment or X-ray exposure, exposure to light, an application of any substance to the skin, or the taking of any medicine.

In a general way the effects of radium are estimated largely by direct methods in contrast to roentgen rays, in which the measurements are often indirect. Because of technical difficulties, it has not yet been possible to accurately measure radium in terms of roentgens.

C. G. SUTHERLAND, M.D.

The Dependence of the Wave Length of Small Ionization Chambers ("Thimble Chambers"). Heinz T. Meyer. *Strahlentherapie*, 1931, XL, 576-589.

The dependence of the wave length of thimble ionization chambers was studied after the addition of Si, Al_2O_3 , MgO, and BeO, to the wall material. The amount of the various substances necessary to be added to the basic chamber material (graphite) in order to obtain wave length independence within a half value layer in copper of from 0.15 to 2.0 mm., was determined. The results of these investigations led the author to the conclusion that not

the effective atomic number of the wall material, as stated by Fricke and Glasser, is the controlling factor, but for a certain shape of chamber a definite number of electrons must be present in the chamber material per unit of volume. The average sensitivity of the chambers, assuming equal volume, is slightly dependent upon the wall thickness and also upon the pressure under which the chambers were made. A slightly pressed porous chamber is less sensitive than a heavily pressed and less porous chamber of equal composition. Chambers with thin walls are less sensitive than those with thick walls.

ERNST A. POHLE, M.D., Ph.D.

MEDICAL PRACTICE

The Present Status of Physiotherapy. The Publication Committee, Canadian Radiological Society. *Can. Med. Assn. Jour.*, March, 1931, XXIV, 409.

Due to the necessity of returning the casualties more quickly to active service, and to the necessity of reducing pensional disability to a minimum, modern physiotherapy found its great impetus during the war. Thousands of technicians were trained to administer treatment by physical agencies under the direction of many medical men specially and intensively trained to direct this work. Under all this stimulus, physiotherapy has now become known as a science as well as an art, and gained world-wide professional recognition. Our largest medical schools have begun to teach their undergraduates the principles on which this subject is based. It is being employed in every mental institution and sanatorium and every pretentious hospital—private, civic, or military—in America. It has received professional recognition by the American Medical Association through its Council on Physiotherapy.

A hasty glance over the field of accomplishment may serve to call to mind that physiotherapy has definite conquest to its credit. In the treatment of malignant diseases, no other single measure surpasses radium in value. In the treatment and diagnostic fields, the X-ray has no near competitor. The testimony of all

sanatoria is proof of the value of sunlight therapy in disease processes. The infra-red ray has possibly relieved more pain than any other single measure. That diathermy can localize heat and influence deep-seated lesions is not seriously questioned to-day by anyone who has made adequate inquiry. In the static current, we have a method of decongestion that has no peer. If massage is indicated, the faradic, sinusoidal, and Morton wave currents will stimulate to function every tissue that has a contractile element in it. The field of galvanism beneficially influences chronic, painful, and degenerative conditions better than any other method of attack which we possess. Hydrotherapeusis will favorably influence any pathologic state.

L. J. CARTER, M.D.

The Relation of Radiology to Other Branches of Medical Practice. Arthur C. Christie. *Jour. Am. Med. Assn.*, May 23, 1931, XCVI, 1747-1749.

The roentgen ray was discovered in 1895, and radium, in 1897. The entire history of radiology, therefore, covers a period of only about thirty-five years. There are no sound reasons, either scientific or economic, for giving radiology a status different from that of other specialties. The same considerations govern here as in other fields; namely, the limitations imposed by practical conditions. Various types of limited radiologic practice are discussed in detail. The position of radiology in schemes of organization is considered.

Roentgenology occupies so broad a field, its technical difficulties are so numerous, and interpretation requires so broad an experience that it constitutes a special branch of medicine. The interests of patient and profession are best conserved when it is so practised.

C. G. SUTHERLAND, M.D.

Rational X-ray and Radium Therapy. Walter A. Weed. *Jour. Florida Med. Assn.*, October, 1930, XVII, 164-167.

The author presents conclusions drawn from sixteen years of experience. The indications

and contra-indications for the therapeutic use of radiant energy are very clearly defined. The radiologist should above all else be unprejudiced, and should be the first to recognize not only the definite indications for his services, but should know his limitations as well. He must know not only the physics of X-ray and radium and the principles of dosage, but should be somewhat of a mechanical genius in order to apply his remedies in the best manner. A combination of X-rays, radium, and electrocoagulation in judicious, experienced, and skillful hands constitutes one of the greatest known weapons in combating certain conditions. The radiologist, with 100 mg.-min. of radium, in addition to a modern X-ray therapy machine and a diathermy apparatus, and who knows how to use them conjointly and separately, can show results comparable to those obtained in large institutions. The X-ray can supplant, for all practical purposes, the use of radium, except in cavities and in treating nevi.

W. W. WATKINS, M.D.

The Status of Radiology. Arthur U. Desjardins. *Jour. Am. Med. Assn.*, May 23, 1931, XCVI, 1749-1753.

Before 1910, it may be said that roentgenology was used chiefly in relation to traumatic and organic lesions of bone and to the pulmonary and cardiac apparatus. The period between 1910 and 1920 was featured mainly by improvements in apparatus and technic, and these were reflected in wide extension of the method to numerous phases of clinical medicine. The outstanding contributions of the decade were related to the gastro-intestinal tract and were made possible by the advent of the opaque meal. Cystography and pyelography made their appearance, and recognition of many lesions of the urinary system became more and more a matter of training and experience.

During the last decade, radiology has advanced more rapidly than ever before. Cholecystography, roentgenography of structures or organs injected with iodized oil, roentgenography after insufflation of gas or air, and intravenous urography have come to facilitate

the diagnostic and therapeutic task of the physician.

The development of radiotherapy has also been marked by rapid progress.

Radiology, as a career, furnishes the best opportunity in medicine to-day—a fresh, fertile, and uncrowded field—in which the ambitious and well-trained young physician can make an enviable place for himself more rapidly than in any of the older branches.

C. G. SUTHERLAND, M.D.

RADIATION SICKNESS

Safety for Radiologist and Patient in Diagnostic and Therapeutic Radiology. Henry K. Pancoast. *Jour. Am. Med. Assn.*, May 23, 1931, XCVI, 1757-1760.

The discovery of the therapeutic properties of X-rays was the outcome of the observation of damage to tissues as the result of prolonged exposure. Death took a heavy toll among the pioneers. Protective measures have had to be devised for those who work with X-rays and radium.

The development of high-powered equipment and the autotransformer control have supplied the additional danger of electrical shock. The film fire hazard has become a more recent menace. The undesirable and annoying "irradiation sickness" can be controlled in a measure, but cannot be altogether avoided.

Excessive irradiation is discussed from the standpoint of the patient and the operator. The author goes into detail concerning electrical shocks, factors in protection against shocks, and the danger of explosive anesthetics being employed in rooms in which open high tension apparatus is used.

The annoying symptoms of roentgen sickness may be minimized by various measures. Radium protection requires care in handling, rotating service for workers, and complete blood counts at regular intervals.

C. G. SUTHERLAND, M.D.

Protection of Patients and Operators from X-rays. Francis Carter Wood. *Jour. Am. Med. Assn.*, May 23, 1931, XCVI, 1760-1762.

Many radiographers and workers in fac-

tories which manufacture X-ray tubes have died from cancer of the skin, due to the lack of knowledge of the dangerous effects of continuous exposure to X-rays, even of long wave length. This danger is now obviated by the remote control which is possible with modern tubes. Sterilization and anemia are still possible. In addition to the danger of either direct or scattered radiation, the air of the rooms in which high voltage currents flow may become contaminated with ozone and nitric oxide fumes, the inhalation of which is deleterious to the health of the personnel and may make sensitive patients ill. Methods of protection are discussed in detail. The efficiency of the protective devices should be examined at installation and frequently thereafter. If fluorescence can be noted with a fluoroscope fitted closely about the eyes, a dangerous amount of radiation is present. Scattered radiation should be checked by carrying a dental film, half-covered with lead, over a period of two weeks.

All persons engaged in radiologic work should have a thorough medical examination at least once a year, and complete blood counts should be made every other month. Any marked diminution in leukocytes or hemoglobin is an indication for a prolonged holiday until the condition is remedied.

A copy of directions for the Schaefer method of artificial respiration should be posted in the radiology department. Any one receiving an electrical shock may die from paralysis of the respiratory center.

C. G. SUTHERLAND, M.D.

RADIUM

Short Survey of Radium Treatment.
Arthur Burrows. *Jour. of Cancer Research Committee of University of Sydney*, February, 1931, XI.

This is a survey of the current practice in radium treatment, with a short preliminary statement of biologic principles. Radiosensitivity refers to cells and not tumors as a whole, and hence, as in some of the round-celled sarcomas, although the growth disappears under treatment, it soon recurs when

treatment is stopped, showing that some of the cells are radiosensitive while others (possibly forms of parent cells) are little influenced and burst forth into growths once more. It was for this reason that the French and Belgian "long time" technics were introduced.

Radiologic treatment is best applied to tumors growing in normal healthy tissue, and it is possible that those growing in tissues with a strong tendency to the formation of fibrous tissue or in the midst of fat will not respond so well to radium treatment. Favorable tumor sites are: the front part of the tongue, the skin, and the cervix of the uterus, not only because of the radiosensitivity of tumors growing in these locations, but also because of their accessibility.

Treatment of the nasal sinuses may be carried out by transirradiation, but, as a rule, it is advantageous to lay them open surgically and convert them from internal to external lesions. Direct methods are inadvisable in the larynx. There is no satisfactory technic for the cancer of the bladder, but the burying of small unscreened radon tubes is suggested. With cancer of the breast, treatment of a widespread nature should be employed, even though the burying of needles may have produced a good local result. The opinion is stated that the future treatment of carcinoma of the breast may be by means of X-rays rather than radium. Operation after irradiation of mammary cancer has advantages and, if performed soon enough after radiation, prevents troublesome fibrosis, although the sealing of the lymphatics would then be imperfect. Carcinoma of the prostate is best treated by needling, *via* the perineum or bladder, supplemented by X-rays.

Amputation is recommended for osteogenic types of bone sarcoma; radiation, perhaps followed by surgical operation or injection of bacterial toxins, for the endothelial and plasma-cell types, while radiation alone without amputation or curettage is recommended for giant-celled sarcomas.

The Heyman, Regaud, and Donaldson technics for treatment of carcinoma of the

cervix uteri are reviewed. In carcinoma of the body of the uterus, the "long time" technics are perhaps not so essential and X-rays may be more effectual.

Radium implantation methods, although usual, are not advised for epithelioma of the vulva, owing to the proximity of bony prominences and the liability to sepsis. External radiation, at a distance of two or three centimeters by use of molds of dental compound, a difficult method in actual practice, or "bomb" methods are desirable. Diathermy and surgery should be considered. In any case, the treatment of the glandular areas of the groin is essential.

Unexplained or non-malignant uterine hemorrhage should be treated with minimal doses, even though it is possible that the treatment may have to be repeated. After the menopause, larger doses may be employed. Uterine hemorrhage in exophthalmic goiter requires treatment of the thyroid; of the uterus only as a last resort. Pelvic pain is not relieved by radium, although the partial or complete temporary suspension of the menses in intractable dysmenorrhea may cure pain of this type, particularly if the periods are excessive.

J. G. STEPHENS, M.D.

Theoretic Foundations of a New Technic for Homogeneous Irradiation with Gamma Rays. G. G. Palmieri. *Strahlentherapie*, 1931, XL, 470-492.

The author believes that the homogeneous irradiation of malignant tumors as proposed by Dessauer, in 1904, is the method of choice. While it is used a good deal in roentgen therapy, too little consideration has been given to that method in radium therapy. In his paper he shows how, with proper arrangements of several radio-active centers, the homogeneous treatment of tissue may be carried out. Experimental proof for his theoretic deduction and detailed data for the treatment technic in typical cases will soon be published.

ERNST A. POHLE, M.D., Ph.D.

Elimination of Radium Salts from the Human Body: Preliminary Report. Frederick B. Flinn. *Jour. Am. Med. Assn.*, May 23, 1931, XCVI, 1763-1765.

It has been shown that soluble and insoluble salts of radium were eliminated whether they had been ingested orally or injected intravenously.

Persons who have received repeated internal doses of radium salts have also been found to be radio-active several years after cessation of treatment. These observations show that there are some people who, because of personal physical conditions or improper diet, have a tendency to store radium in their bones. An analysis of the excreta of these persons indicates a low rate of elimination. This is a preliminary report in the use of viosterol to increase the rate of elimination. The author hopes sometime in the near future to report a complete elimination in all cases and to present roentgenograms showing an improved condition of the bone.

C. G. SUTHERLAND, M.D.

Our Experience with the Injection of "Beta Radiators" in Malignant Tumors. Hellmut Kamniker. *Strahlentherapie*, 1931, XL, 427-437.

Loeb and Wreschner prepared an iron hydroxid Uran-X compound, with a half decay period of 24 days, for injection into accessible malignant tumors. The author tried it in a series of far-advanced cases and came, after analyses of the respective histories, to the following conclusions: The "beta radiators" are very effective and a welcome help in the treatment of carcinoma, particularly in cases in which, for anatomical reasons, the application of radium element is impossible. Injections should not be given in deep-seated malignancies, because otherwise there might result a perforation of the necrotic tumor into cavities or neighboring organs. Sometimes it is advisable to inject an area from the edge to the center of the tumor, in order to guarantee drainage of the necrotic material. This may also later on permit the application of screened radium. Repeated injections at short intervals are contra-indicated. No undesirable re-

actions were observed either in the kidneys or in the blood. Histologically, necrosis of the tumor can be seen. Clinically, the injected tissue usually undergoes liquidation and is, in favorable cases, replaced by scar tissue.

ERNST A. POHLE, M.D., Ph.D.

So-called Late Reactions Following Radium Treatment in Gynecology. St. Liebhart and E. Meisels. *Strahlentherapie*, 1931, XL, 508-514.

The author first discusses briefly our present opinion concerning late injuries following irradiation. He then reports a case which was observed in his clinic. A woman of 59 years was treated for carcinoma of the cervix with roentgen rays and radium, beginning in April, 1927. Sixteen X-ray treatments of 6 H units each, and a total of 3,600 mg.-hrs. of radium were applied. The carcinoma healed, and in July, 1928, a whitish, glossy scar was seen in the vagina. In June, 1929, the patient returned, complaining of severe back pain and tenesmus. She had lost weight and felt rather weak. In the posterior wall of the vagina a diffuse infiltration was seen, with an ulcer about the size of a quarter. Biopsy showed a histologic picture very suspicious of a recurrence. However, from a clinical standpoint, this ulceration was interpreted as a probable late reaction and treated accordingly. Four weeks later the ulceration had healed, and in April, 1930, the patient was still well.

ERNST A. POHLE, M.D., Ph.D.

The Technic of Radium Therapy To-day. Duncan C. L. Fitzwilliams. *Brit. Med. Jour.*, Aug. 30, 1930, II, 309-311.

The ideal method of radium application, namely, the introduction of radio-active substances which will circulate through the body and act on the primary growth, is at present beyond our powers, and we are limited to the introduction of radium foci locally. The use of radium has now reached a position where we know that in the treatment of carcinoma it is on a par with surgery. It is introduced locally in seeds, needles, tubes, or bombs. The different methods of application are discussed, *viz.*: (1) The intra-cavitation method; (2)

the interstitial method; (3) surface irradiation; (4) distance radiation.

In the use of radon, accurate dosage is difficult, as it is not always known when it was prepared. In twenty-four hours it loses 18 per cent of its power, and in three days, 50 per cent.

The author discusses dosage and the way it has been revolutionized by the work of Professor Regaud, of Paris, who has influenced us to use smaller doses over longer periods of time. Radium acts best in a virgin soil, but if the second dose follows after only a very short interval, the same good results are seen. While the immediate effects of radium therapy are well known, there are remote results which are not understood. The tissues are altered in such a way that some quite slight injury may cause necrosis and death. For instance, he warns against such irritations as result from dental plates or too hot baths.

The chief limits of radium treatment are inaccessibility and late diagnosis. Also, some carcinomas, as in the body of the uterus, are resistant to radium. The treatment requires the knowledge and experience of a specialist, and it is a remarkable fact that radium therapy has survived in spite of the indiscriminate distribution of radium and radon about the country.

W. D. MACKENZIE, M.D.

Radium Treatment of Epitheliomas of the Skin. Roy Ward. *Brit. Med. Jour.*, Sept. 27, 1930, II, 511-513.

The results of treatment of 1,773 cases of rodent ulcer by radium at the Radium Institute, London, are reported. Of all cases, 77 per cent are reported as cures. Of 240 cases that had previously become refractory to X-rays, 102 were healed as a result of radium treatment.

As biopsy tends to activate the growth, it is done only to confirm diagnosis in doubtful cases. In the treatment the fundamental principle is to estimate the dose sufficiently to bring about the death of all the malignant cells without impairing the vitality of the surrounding normal tissue, so that healing may take place satisfactorily.

Small hypertrophic growths mobile on the underlying structures should be treated by surface radiation from an unscreened full-strength applicator containing 5 mg. of radium element per square centimeter. All crusts are first removed and the surrounding skin is protected by rubber-covered lead sheeting. Exposure lasts from one to two hours, according to the thickness of the lesion. When it is necessary to limit the irradiated area on account of the proximity of especially sensitive organs, it is advisable to use buried radium in the form of screened seeds.

In large hypertrophic growths, in order to obtain homogeneous distribution, it is necessary to use screened apparatus—for example, needles buried in and around the growth—and no part of the growth should be farther than one centimeter from the source of irradiation. Also, more massive doses should be placed at the periphery, in order to obtain a homogeneous distribution.

In the superficial ulcerative variety the treatment is similar to that of the hypertrophic growths from which they have originated.

In the superficial cicatrizing variety, unscreened radium plaques are used, and it is necessary to irradiate a considerable distance beyond the visible margin of the growth, as outlying columns of cells are undoubtedly present in these locations.

In the deep ulcerative variety we have the most severe form of basal-celled epithelioma and the most difficult to treat. Gamma radiation must be used; beta radiation with unscreened or lightly screened radium is not suitable. In order to avoid the disadvantages of prolonged exposures on the one hand, and insufficient amounts of screenage on the other, much larger amounts of radium, screened through a minimum of 2 mm. of lead or its equivalent for a comparatively short period, are employed. In addition, means must be found to absorb the secondary radiations, and sometimes this is done by the interposition of Columbia wax or sorbo rubber, a measure which also provides a more homogeneous dose, by the distance which is created between the radium and the lesion. With this technic the

duration of treatment varies between forty-eight and seventy-two hours. If the time is increased beyond a total of seventy-two hours, damaging effect may be produced, especially in old persons. (Recently the use of needles or screened seeds has in some cases replaced or supplemented surface treatment.) If, however, bone or cartilage has been invaded, an even shorter exposure will be advisable, since these structures, especially when devitalized by the invasion of the neoplasm, have a great tendency to radium necrosis. About one-third of the treated cases healed.

As to the question of repetition of irradiation treatment, there is no doubt but that it is best to give the maximum dose at the first treatment, for after each successive dose the rodent ulcer becomes more refractory to treatment. On the other hand, a growth which has proved refractory to beta irradiation will often respond to gamma radiation. Previous treatments produce an avascularity of the tissues, rendering them more susceptible to radium necrosis, and, therefore, thicker screening may be necessary for further exposures.

Radium should never be employed within six weeks of any previous treatment. Details of any previous treatment, X-ray or radium, its dosage and subsequent reaction, must be taken into consideration when estimating a given dose, if "radium burns" are to be avoided. The term "radium burns" is not applied to the simple vesication and ulceration which follow upon an unscreened radium exposure and which are essential parts of the reaction, but is reserved for those few instances in which the dosage has been excessive and the resultant ulceration is extreme in degree, with severe persistent pain and slow repair.

The following special points in prognosis are mentioned:

Ulcers in certain situations, such as the forehead, ear, and inner canthus, have a serious prognosis. When a mucous membrane is implicated, the condition also proves more resistant, and is often eradicated only by free excision. When an ulcer becomes secondarily infected it often responds poorly to radium.

In some cases the sepsis appears to be aggravated by treatment, thereby only adding to the patient's discomfort.

Squamous epitheliomas of the skin differ from rodent ulcers in their more rapid growth and their formation of metastatic deposits in the neighboring lymphatic glands. In the early stages of the disease, the results of excision with the radioknife are so good that radium should be reserved for the more extensive cases.

WALLACE D. MACKENZIE, M.D.

The Use of Radium in Benign Uterine Hemorrhage. Gerard Raap. *Jour. Fla. Med. Assn.*, December, 1930, XVII, 273-275.

The author quotes Howard Kelly as follows: "He who would give his patients the same consideration he would give his wife, or sister, must put radium first in the treatment of fibroid tumors. In uncomplicated fibroids, there is no treatment quite so satisfactory."

Among the benign pathologies of the uterus amenable to radium, most of them at some stage are complicated by hemorrhage, and among those in which radium is indicated the author mentions: Uterine fibroid; metrorrhagia and menorrhagia; hemorrhage of climacteric; endocervicitis and cervicitis, and surgical conditions in which the control of hemorrhage is essential to surgery. Ovarian extracts are used to control the symptoms during the induced climacteric. Estrogen is mentioned as a probable improvement over extracts heretofore available.

W. W. WATKINS, M.D.

Further Observations on the Use of Radium in the Control of Subcutaneous and Mucous Membrane Hemorrhage by Irradiation of the Spleen. J. M. Hoffman. *Jour. Fla. Med. Assn.*, December, 1930, XVII, 265-268.

In a previous communication the use of this method in cases of hemophilia, purpura hemorrhagica, and hemorrhagic disease of the newborn was reported. Three additional cases are cited in this paper. If the blood volume

is low, the method should not be used, but blood transfusion. The technic recommended is as follows: 50 mgm. of radium in a large brass capsule placed at one-inch distance from the skin over the spleen, with a dosage of from 300 to 400 milligram-hours.

W. W. WATKINS, M.D.

ROENTGENOTHERAPY

X-ray Therapy of Inflammatory Conditions. Klövekorn. *Schweiz. med. Wchnschr.*, April 25, 1931, LXI, 408.

In chronic adnexal inflammatory processes, the author applies a dose of 150 r three times, at eight-day intervals. For furuncles of the upper lip, nose, and external auditory canal, he has applied from 80 to 100 r. In mastitis of infants, a maximum of 10 per cent S. E. D. produces astonishing results. A somewhat larger dose is necessary in adults. Good results follow the early irradiation of paronychia. The results of the treatment for erysipelas are questionable. Phlegmons and panaritria should not be irradiated.

H. C. OCHSNER, M.D.

The Differential Action of X-rays on Tissue Growth and Vitality (Part 1). Warnford Moppett. *Jour. Cancer Research Committee of University of Sydney*, February, 1931, II. (Reprinted from *Proc. Royal Society, London, B*, CV, 402.)

This is an important paper, giving the results of four years' research. The work is of unique interest although it awaits the confirmation of other investigators.

A feature of the investigations was the use of X-rays reflected from a calcite crystal. Thus, a far higher degree of monochromaticity was secured than could be obtained with the use of filters, as has been the case in most other experiments on the effects of X-ray of various wave lengths.

Three important results are stated:

- (1) Almost purely monochromatic X-rays of not very different wave lengths may produce vastly different biologic effects.
- (2) X-rays of different wave lengths may exert antagonistic biologic effects.

(3) Small doses of almost purely monochromatic X-radiation of certain wave lengths produce stimulation of tissue growths and hypertrophy, while larger doses of the same wave length produce atrophy.

The tissue investigated was the chorio-allantoic membrane of the chick, which presents a vascular mesenchyme enclosed by two layers of epithelium. It is thus an embryonic tissue, a restriction which should be borne in mind.

The technic consisted in removing a portion of the shell of fertile eggs which had been incubated from eight to nine days. Through this window, about 8×16 mm. in size, the non-living shell membrane immediately beneath the shell was displayed. During the irradiation, the eggs were contained in a small incubator, and the detached portion of shell was sealed in position with paraffin wax after the experiments. After further incubation for four days, the specimens were examined macroscopically and microscopically.

With the aid of a physicist, W. H. Love, almost purely monochromatic radiation was obtained by reflection from a calcite crystal, the monochromaticity being limited only by the width of the slit.

The degree of resolution of the radiation may be inferred from the fact that experiments were performed at 0.32 \AA. , 0.36 \AA. , 0.42 \AA. , etc., and at similar intervals over the entire spectral range, from 0.32 \AA. to 2.00 \AA. It should be noted that this range is softer than that employed in deep therapy practice. A harder wave length range, from 0.1 \AA. to 0.3 \AA. , is mentioned and shown in a diagram, but it is not discussed and apparently refers to an earlier paper.

By employing the white radiation from the target and avoiding its spectral lines, it was possible to secure equal intensities of radiation at each of the wave lengths. Details not mentioned by the author are that the X-ray tube was an air-cooled Coolidge therapy tube energized by a Gaiffe-Gallot constant potential machine.

The energy or intensity was checked by two independent methods of measurement, the

ionization and the photographic. A constant time of exposure was employed, thus eliminating various time-factor complexities. Over the wave length range 0.32 \AA. to 0.8 \AA. the exposure time was two hours, but for other wave lengths it was not stated. In order to observe the effect of lesser dosage, a moving shutter was arranged so that, although the total time of exposure was two hours, certain portions of the membrane could be screened for a greater or less time during the exposure.

Altogether 680 eggs were exposed, and, subtracting those in which the embryo died, the author states that "about 440 experiments were determinants." Controls without X-radiation were employed at every stage of the investigation and in each case gave negative results.

The results obtained are uniquely interesting. The diagrams and statement of these results are, however, difficult to follow and require prolonged perusal.

(1) Every wave length in suitable dose produces hypertrophy; there are no ineffective wave lengths.

(2) Increase in dosage at certain narrowly defined wave lengths produces atrophy, while at all other wave lengths hypertrophy alone can be produced, even when the dose is greatly increased.

For example, with a dosage time of two hours, hypertrophy is produced at 0.48 \AA. , atrophy at 0.53 \AA. , hypertrophy at 0.64 \AA. , and atrophy at 0.8 \AA. Increase in dosage time does not alter this relationship, whilst decrease causes hypertrophy at 0.53 \AA. and 0.8 \AA. and no effect or very slight hypertrophy at other wave lengths. Atrophy is thus a specific effect which can be produced at certain definite regions only, notably 0.53 \AA. Hypertrophy manifests itself as a raised plaque, atrophy as a punched-out ulcer.

It is significant that the atrophy-producing wave length 0.53 \AA. with the width of slit employed would include the *L*-absorption edge of uranium, the wave length 0.8 \AA. corresponding approximately to the *L*-absorption edges of lead, while the hypertrophy-producing

wave length 0.64 would include the *K*-absorption edge of molybdenum. Traces of these metals were demonstrated chemically in eggs of the same batch in collateral researches by Bishop and Mankin. Thus, it may be possible to interpret the selective effect as arising from photochemical sensitization of the membrane to certain wave lengths.

(3) The author also finds evidence of specific stimulation of individual tissues, such as epithelia, by particular wave lengths.

(4) The most remarkable of the results obtained, however, is the fact that when the chorio-allantoic membrane was exposed to the full unfiltered radiation from the X-ray tube for a period of fifteen minutes, no biologic changes whatever were detected. And yet measurements showed that the intensity of the full beam was approximately one thousand times that of the monochromatic radiation (reflected from the calcite crystal) which caused atrophy. No obvious flaw is to be seen in the author's statement of his experimental technic. It is regrettable that the voltage and milliamperage energizing the tube are not stated, and that no dose in human erythema units is stated, or even an approximation.

Inquiry elicited the information that the tube conditions were: 60 K.V., 4 ma. target-membrane distance 35 centimeters. Thus, for the fifteen minutes' exposure the dose of heterogeneous rays on the membrane was probably less than a human erythema dose. This produced no effect. It is extraordinary that with monochromatic radiation of only one-thousandth, the intensity of the heterogeneous radiation from which it was derived should produce atrophy. For a two-hour exposure the dose would thus be only one-one hundred and twentieth that of the mixed beam, which was ineffective in fifteen minutes.

The hypothesis of antagonistic effects of different wave lengths is put forward to explain the above effects. Confirmatory evidence was found in the fact that widening the slit and thus decreasing the degree of monochromaticity when employing an atrophy-producing wave length "tends to neutralize the reaction."

Moreover, the fact that no effect could be produced in the membrane with the shell intact is explained as being due to the antagonistic effect of the radiation scattered by the shell interfering with the monochromatic radiation. Controls in which the window was removed for several hours and replaced without irradiation showed no effect. Controls in which the window was removed for two hours, then replaced, and then irradiated would seem to be desirable, however, rigorously to exclude the summational effect of two irritants—irradiation and window-making.

Further, a preliminary exposure to the full mixed radiation of the tube for ten minutes completely prevented the production of any reaction whatever when the same membrane was immediately afterward exposed to the atrophy-producing monochromatic beam for the usual period of two hours. Strangely enough, the reverse procedure does not interfere with the atrophy; that is, when the mixed beam is applied after the monochromatic beam.

Other experiments showing the antagonism of different wave lengths are described. The occurrence of the typical membrane reactions when all of the contents of the egg (but not the shell) are interposed in the path of the monochromatic X-ray beam is of great importance clinically, because this shows that if monochromatic radiation could be applied to a patient, the scattering caused by soft tissues between the skin and a tumor would not debase the purity of the beam to an extent that would neutralize the specific wave length effect.

The work awaits confirmation by other investigators.

J. G. STEPHENS, M.D.

Roentgenotherapy of Hypertrophy of the Prostate. J. Grünthal. *Röntgenpraxis*, April 15, 1931, III, 364-370.

The roentgenologic treatment of prostatic hypertrophy has been reported by many authors. They do not all agree as to the results. Grünthal has applied roentgenotherapy in 26 cases, which were inoperable on account of

complications (20) or refused operation (6). Sixteen cases had a complete retention; 12 of these (75 per cent) were successfully treated, and could urinate again without having to use a catheter; while in three of these, two treatment series were necessary. A complicating cystitis was not aggravated. The patients have been followed up from six months to three years. One must apply from 95 to 100 per cent of a skin erythema dose to the prostate, and not only from 70 to 75 per cent, as so many have done.

The author's technic was as follows: 200 K.V., a filtration of 0.8 mm. Cu, from 4 to 6 fields of from 8 to 10 and 10 to 15 square centimeters, and an effective dose of from 90 to 100 per cent of a skin erythema on the prostate.

Tabulations with histories of patients, findings, treatment dates, and results are given.

H. W. HEFKE, M.D.

Alterations in the Blood Calcium Level after Radiotherapy. Langeron, Desplats, Paget, and Guémère. *La Presse Méd.*, March 28, 1931, XXXIX, 457.

X-rays were applied to the suprarenals and the cervical sympathetic. The irradiation was followed by an immediate increase in blood calcium, lasting for twenty-four hours, with a fall of varying degrees for several days. The fall was accompanied by a third phase, during which the blood calcium was again increased to or above the previous level. Irradiation of the suprarenals was followed by a greater initial increase, while irradiation of the cervical sympathetic was accompanied by a greater late increase in the blood calcium.

WALTER M. LEVITT, M.B., M.R.C.P., D.M.R.E.

Radiation Therapy in Gynecology. Bickenbach and Haupt. *Schweiz. Med. Wchnschr.*, April 25, 1931, LXI, 408.

The author describes the methods of treatment of metropathies, carcinoma of the vulva, and ovarian carcinoma. In juvenile bleeding, he has had excellent results following the application of from 150 to 175 r to the spleen.

H. C. OCHSNER, M.D.

Curative Deep X-ray Therapy in Prostatic Hypertrophy. P. Lehmann. *La Presse Méd.*, April 8, 1931, XXXIX, 510.

The author believes that medium voltage X-ray therapy gives only mediocre results in prostatic hypertrophy. With deep X-ray therapy, however, provided that the dosage is sufficient, good results are obtained. A series of 36 cases treated during the past six years is referred to, in which subsequent operation has been necessary in only one. Many of the patients had resorted to catheter life before the treatment, and have been well since. Only a brief account of the communication to the Medical Society of Paris is given, and there are no details of the technic.

WALTER M. LEVITT, M.B., M.R.C.P., D.M.R.E.

Leukoplakia Buccalis: A Study of Eighty Cases. Howard King and C. M. Hamilton. *Southern Med. Jour.*, May, 1931, XXIV, 380-383.

Leukoplakia rarely occurs in youth. Tobacco is the most prevalent etiologic factor, syphilis playing a minor rôle. It is resistant to treatment. Leukokeratoses are removed by electrocoagulation, the radium plaque not being used at present, after having been tried and found unsatisfactory. This seems strange because the best results on lip lesions have been secured with X-ray therapy, giving from three to five skin units. Cases in which carcinoma has developed were irradiated with radium and destroyed by electrocoagulation immediately afterwards. Mild lesions of leukoplakia over large areas should not receive strong applications.

W. W. WATKINS, M.D.

Treatment of Surgical Tuberculosis with the X-ray. Janker. *Schweiz. med. Wchnschr.*, April 25, 1931, LXI, 407.

The greater the involvement the greater caution should be exercised. The author gives tabulations governing the amount of irradiation for simple or infected lymphoma. A relatively much lighter dose is given to severe or early infections. The treatment of bone and joint tuberculosis depends upon whether the lesion is open or closed. Closed lesions

are given from 5 to 15 per cent S. E. D., and open lesions from 40 to 70 per cent S. E. D. A filtration of 0.5 mm. Cu, plus 1 mm. Al, and a point gap of from 30 to 40 cm. are used. In spina ventosa, a 5 to 10 per cent S. E. D. is repeated three times, at intervals of eight days, and further treatment may be given in from three to six months. In tuberculosis of the skull, 20 per cent S. E. D. is repeated from six to eight times, at intervals of from three to six weeks. In tuberculosis of the spine, 10 to 20 per cent S. E. D. is given at intervals of from three to six weeks. Further treatment may be given after from three to six months.

H. C. OCHSNER, M.D.

The Treatment of Prostatic Hypertrophy by Deep X-ray Therapy. Guilbert. *La Presse Méd.*, April 11, 1931, XXXIX, 526.

There are reservations to be made in claiming curative value for deep X-ray therapy in prostatic hypertrophy. Cure may be obtained only in the early stages before sclerosis has occurred. The slightest vesical infection is an absolute contra-indication.

WALTER M. LEVITT, M.B., M.R.C.P., D.M.R.E.

SKIN (GENERAL)

The Effect of Sunlight on the Immunizing Function of the Skin. Pierre Woringer. *Strahlentherapie*, 1931, XXXIX, 493.

The author states that there are many clinical observations in favor of the contention that light tends to increase and accelerate the specific reactions of the organism towards infections. As an example, he quotes the fact that in measles, irradiated skin reacts quicker and more intensely than unexposed skin. He assumes that most exanthematous diseases will show similar skin reactions.

ERNST A. POHLE, M.D., Ph.D.

Further Contributions to the Histology of Sensitized Roentgen Irradiated Skin. H.-G. Bode. *Strahlentherapie*, 1931, XL, 515-545.

The histologic changes in the skin of guinea-pigs after the application of tincture of iodine, 10 per cent chrysarobin vaseline, and croton oil, with X-rays alone, and with a combination of X-rays and the above mentioned agents,

were studied. No macroscopic difference could be seen between the areas treated by X-rays alone and those exposed after sensitization. The inflammatory processes produced by tincture of iodine, croton oil, or the 10 per cent chrysarobin vaseline decrease slowly during the first 15 days after the application, and the microscopic picture finally shows almost normal skin. If sensitized skin is exposed to roentgen rays up to 15 days after sensitization, the structural changes are definitely increased, as compared with non-sensitized irradiated skin. The degenerative changes in skin sensitized with tincture of iodine or croton oil have their maximum after roentgen exposure is carried out for 9 or 7 days, respectively, after sensitization. If the skin is irradiated before this interval, there is a steady increase in the intensity of the histologic changes in the sensitized irradiated skin, as compared with non-sensitized skin. The greater the interval between sensitization and roentgen exposure the greater the changes. If, following sensitization with chrysarobin vaseline, the roentgen exposure is carried out later than 5 days afterwards, there is very little difference between the changes observed in sensitized and non-sensitized skin.

ERNST A. POHLE, M.D., Ph.D.

SURGERY

New Technic and Instrument for Obtaining Biopsy Specimens. William J. Hoffman. *Am. Jour. Cancer*, January, 1931, XV, 212-220.

The author discusses the various means of obtaining biopsy specimens and the disadvantages attendant upon these methods. He feels that an ideal instrument for obtaining biopsy specimens ought to satisfy the following requirements:

1. It should be safe.
2. It should not favor the spread of the tumor.
3. It should be simple and sturdy in construction, easily adjusted and assembled, easily cleansed of all tumor tissue, and readily sterilized.
4. It should be possible in nearly all cases to obtain with the instrument a piece of tissue

through a small puncture wound on the first attempt, thus inflicting the minimum of trauma.

5. If a greater quantity of material is desired, it should be possible to obtain it without making a new breach in the capsule of the tumor.

6. It should be capable of removing all types of material.

7. It should be capable of obtaining a sufficient amount of tissue for a complete examination.

8. It should provide some means for sealing the breach in the tumor and killing any tumor cell along the tract of the instrument.

The author believes that his instrument fulfills the above conditions. It consists essentially of a slender steel sheaf, the outer surface of which is electrically insulated, except for a narrow band of exposed metal at one end, which is honed to a cutting edge. The hollow sheaf is built to receive any one of several members designed to puncture a hole, to cut off and grasp a piece of tissue, to withdraw the tissue fragment through the sheaf, and later to coagulate the tract by high frequency current.

In the hands of the author, the action of this instrument is safe and simple. It has been successfully used on many dense fibrous tumors.

JOHN R. CARTY, M.D.

Surgery of the Phrenic Nerve in Treatment of Intractable Hiccup. Carnes Weeks. *Ann. Surg.*, April, 1931, XCIII, 811-815.

In post-operative intractable hiccup, if all the usual methods of treatment fail, the patient should be fluoroscoped to determine which side of the diaphragm is involved. The phrenic nerve on the involved side should then be exposed under a local anesthetic, and a stout silk ligature passed about it. The nerve can then be anesthetized, which may last for as long as eight hours. Following this, traction may be tried, and if it fails the nerve can easily be exposed and crushed. If, at operation, novocaine block and traction prove unsuccessful, this should lead one to believe that

there is nerve anastomosis below the site of section or blocking, and the nerve should then be avulsed. If fluoroscopy shows both sides of the diaphragm to be involved, then both phrenic nerves should be exposed and blocked either temporarily or permanently.

F. B. MANDEVILLE, M.D.

THYMUS (DIAGNOSIS)

Roentgenology of the Thymus in Infancy and Differential Diagnoses of Enlarged Thymus and its Treatment. Henry K. Pancoast. *Am. Jour. Med. Sci.*, December, 1930, CLXXX, 745.

The author has described in this article a very complete method of examining the thymus in infancy. He uses posterior-anterior and lateral views, both at inspiration and expiration, in order to determine the lateral deviation of the trachea, narrowing of the trachea at the thoracic inlet during inspiration, and, if there is more than a normal amount of collapse at the thoracic inlet, at the expiratory phase.

He believes that the diagnosis of thymic enlargement has been based in the past upon erroneous roentgenologic evidence. The only definite and reliable signs of an enlarged or potentially dangerous gland are abnormal narrowing or buckling of the trachea at the thoracic inlet, as it passes over the apex of the gland, and lateral deviation. The unusual width of the gland is apparently of no particular significance, and one producing a narrow shadow is likely to be far more dangerous than a wide one. The roentgenologist must have in mind certain conditions that may confuse the diagnosis, such as asthma, whooping cough, meningitis, and congenital heart lesions; therefore he must exclude any other form of upper respiratory tract obstruction which he may be able to show, such as foreign bodies, obstructive specific laryngeal infections, post-diphtheritic and other forms of acquired or congenital stenosis, retropharyngeal or retrotracheal abscess, adenoids, atelectasis, and unusual collapse of soft tissues.

The treatment of thymic enlargement in infancy is discussed in further detail.

ROE J. MATER, M.D.

The Thymus. A. Stanley Kirkland. *Canadian Med. Assn. Jour.*, November, 1930, XXIII, 661.

Children with thymic symptoms may be divided into three age groups: (1) Those who have difficulty in the first few hours of life; (2) those whose difficulty appears in the first few weeks of life; (3) those whose persistently enlarged or hyperfunctioning thymus endangers their lives during the years up to puberty or even later.

The first group shows difficult breathing from the start, cyanosis being a conspicuous and persistent symptom. Enlargement of the thymus is nearly always present, and very frequently there is a definite atelectasis.

The second group provides the combination of symptoms which are classically described in all discussions of the thymus. A mild or moderate degree of cyanosis, with difficulty in nursing, are frequently the only indications evident to the careful observer. Convulsions are a common feature. During the convulsions, the cyanosis and dyspnea increase, and the inspiratory cry or crow will often be noted. The cry of the child with thymus enlargement is brassy, mechanical, and often terrifying.

The third group carries only a degree of potential danger. These have a persistently enlarged thymus, and their risk consists in the possibility that they may require the administration of an anesthetic for surgical treatment. A child of this type may die suddenly during primary anesthesia or succumb unaccountably to an apparently trifling infection.

Most observers are agreed that it is impossible to arrive at any conclusion as to the normal size, shape, and weight of the gland. Very exhaustive studies have been undertaken by several anatomists, pediatricists, and roentgenologists, but their efforts have done little to give us a picture of what a normal thymus should be. What is to be taken as the normal thymus shadow? The author feels, with many others, that any shadow appreciably wider than that cast by the vertebral column should be considered abnormal, and certainly any asymmetrical shadow extending over a portion of either lung-field is a matter for serious consideration.

However, the size of the gland shadow is not the chief importance. Thymic hyperfunction or dysfunction is the condition with which we are concerned. Possibly too much stress has been laid on the enlargement of the thymus as shown by the X-ray. It may be granted that the gland sometimes produces symptoms mechanically, by pressing on the very important venous and arterial structures with which it is in contact. Nevertheless, many times the X-ray fails to show any thymic shadow in children, exhibiting typical thymus asthma, who react well to thymus radiation. Again, in others in which a large shadow is found, X-radiation will relieve symptoms, with little or no change in the size of the shadow.

The treatment of thymic disturbance should always be by radiation. The child with an abnormal thymus should receive X-ray therapy as soon as the condition is recognized. This type of treatment has changed what was an extremely fatal condition to one rarely fatal.

There is some difference of opinion as to the relative value of X-ray and radium, both as to therapeutic value and as to ease of application. X-ray is equally easy of application, and is available in many situations where radium is out of the question. The cost of X-ray is less and the results are equally good, if not better.

X-ray treatment should be continued until the symptoms are relieved and then immediately stopped. It was formerly the author's practice to give three treatments over the upper sternum, at weekly intervals: latterly the patients have rarely received more than one or two exposures, chiefly because they began to improve not later than ten days after the first treatment. Again, the necessary number of treatments has been reduced because the clinicians found that by giving calcium chloride in small doses the effect of the X-ray is aided. Occasionally symptoms recur at a more or less remote period, and the treatments may need to be repeated.

L. J. CARTER, M.D.

TUBERCULOSIS (DIAGNOSIS)

Acute Generalized Tuberculosis without Typical Tubercles. William A. Reilly and Zera E. Bolin. *Am. Jour. Dis. Child.*, March, 1931, **XLI**, 582-590.

The authors report the case of an infant in whose blood stream the distribution of tubercle bacilli was followed by lesions. These showed few mononuclear cells, no giant cells, few lymphocytes, and large numbers of polymorphonuclear cells, with many tubercle bacilli in each lesion. The explanation offered for this type of lesion is the large number of bacilli present, coupled with the non-resistance and lack of allergy of the patient.

A roentgenogram of the chest showed a process suggestive of miliary tuberculosis. The individual shadows were somewhat larger than miliary tubercles, and the roentgenologist, at the time of reading the film, believed the picture was consistent with streptococcic bronchopneumonia.

F. B. MANDEVILLE, M.D.

Tuberculosis of the Intervertebral Articulations. Howard P. Doub and Carl E. Badgley. *Am. Jour. Roentgenol. and Rad. Ther.*, March, 1931, **XXV**, 299-307.

In addition to the two commoner types of vertebral tuberculosis, the one being central involvement of the body of the vertebra and the other involvement of the anterior portion of the body, with early bone destruction, the authors recognize a third small group of cases to which they apply the term "intervertebral articular tuberculosis," in preference to the previously given term "epiphyseal tuberculosis of the vertebral body."

Three patients varying in age between fifteen and twenty-five and representing the last named type are presented. The characteristic clinical syndrome was prolonged prodromal stages of repeated attacks of backache, radiating to the sacro-iliacs and down the back of the legs. There was no evidence of kyphos, but roentgenologically the patients showed definite diminution of one intervertebral space. Two of the cases, showing marked abscess formation, were proven by guinea-pig inoculation with abscess material to be of

tuberculous etiology. The pain symptoms were all below the level of the lesion, hence, thorough, careful roentgenologic study was necessary to establish the diagnosis.

J. E. HABBE, M.D.

A Study of Intestinal Tuberculosis. W. C. Davis. *United States Vet. Bureau Med. Bull.*, April, 1931, **VII**, 344-352.

The author has modeled his technic of studying intestinal tuberculosis after the method of Brown and Sampson. He requests the patient to take no laxative for 48 hours prior to the examination and to abstain from food the morning of the examination. A primary test meal consisting of barium sulphate, cocoa, sugar, flour, and sweet milk is given to the patient at 3 A. M. Fluoroscopic and roentgenographic examinations are made six hours later. The patient is then given a second meal of buttermilk and barium sulphate, which is followed by fluoroscopic and roentgenographic studies at the seventh hour. At the eighth hour a film only is made. Fluoroscopy is done at the twenty-fifth hour after the secondary meal in order that the structures may be identified. A roentgenogram is then made for a record.

The diagnosis of cecal and colonic irritation is based upon evidence of local irritability and general colonic hypermotility, which is indicated by failure of the colon to retain barium for a period within normal limits. A complete study of the colon must include employment of the opaque enema, because of its substantiating value and the possibility of demonstration of spasm lacking in the meal results. In the author's opinion, a definite demonstration of local spasm in the proximal colon without definite colonic hypermotility is sufficient basis for a positive diagnosis.

The most common symptoms observed in intestinal tuberculosis are those resulting from the presence of intestinal gas. The presence of such intestinal symptoms, however, is not considered a reliable basis for a diagnosis. In conjunction with the X-ray they may be of some value. However, a positive diagnosis based upon X-ray evidence is justified even in the absence of gastro-intestinal symptoms.

In the treatment of intestinal tuberculosis, the author stresses especially the great importance of physical rest. A strict diet regimen is not indicated, except in cases in which the clinical and X-ray signs are marked.

J. N. ANÉ, M.D.

Tuberculosis in the Mesenteric Lymph Nodes of Children. Marion Leonard. *Am. Jour. Dis. Child.*, March, 1931, **XLI**, 513-527.

An analysis of the clinical and pathologic records of the New Haven Hospital is made in an attempt to study the incidence of tuberculosis in the mesenteric lymph nodes of children and the association of these nodes with other localizations of the disease. In a series of 161 children under 15 years of age, dying of all causes, there was anatomic evidence of tuberculosis somewhere in the body in 50 cases. Twenty-two of the children were under two years of age. In 28 cases, tuberculosis was considered the primary cause of death, including 19 cases of generalized miliary tuberculosis, 11 cases of tuberculous meningitis, and 7 cases of tuberculous peritonitis. Caseation of the mesenteric lymph nodes was present in 15 patients who died of generalized miliary tuberculosis, and in only three cases was there evidence of calcification of these nodes. Forty-five cases gave evidence of tuberculosis in the mesenteric nodes, 27 showing caseation, 11 caseation and calcification, and 7 calcification without evidence of caseation. Five of the 18 cases which showed calcified mesenteric nodes were in children under two years of age, the youngest being six months old, and all four cases in the group from 14 to 15 years showed calcification of the mesenteric nodes. The remaining 8 cases were in children between the ages of two and 14 years. In 18 cases, tuberculosis of the mesenteric nodes was the only demonstrable tuberculous infection in the body, and no other tissue was found which was the sole site of tuberculosis.

The author concludes that there is a high incidence of tuberculosis in the mesenteric lymph nodes in children, and there is ap-

parently little relation between chronological age and calcification as a pathologic process in children. The intestinal lymphatic system apparently plays an important rôle in tuberculous infection in childhood. The author cites the work of Dunham and Smythe, who noted 21 cases, or 17 per cent, to have roentgenologically demonstrable evidence of calcified mesenteric lymph nodes, in a series of 120 children giving positive tuberculous tests.

F. B. MANDEVILLE, M.D.

Roentgenographic Re-examination of the Chests of Children from Six to Ten Months after Measles. Jerome L. Kohn and Henry Koiransky. *Am. Jour. Dis. Child.*, March, 1931, **XLI**, 500-506.

In a previous paper, the authors reported observations on successive roentgenograms of the chests of 130 children taken during measles. It was shown that shadows suggesting pulmonic infiltration were present in 62.4 per cent, less than four years of age, and in 42.2 per cent, four years of age and over. Abnormal intensity of pulmonary markings, pleuropulmonary changes, and progressive and retrogressive hilum changes were also present.

In this study, roentgenographic re-examination of the chests of 56 children was made from six to ten months after measles. In addition, an interval history was obtained, and a physical examination was made. According to the authors, previous pneumonic infiltrations, even when extensive and of long duration, showed little residual or no pulmonary changes on the X-ray re-examination. These changes, when present, were described as localized accentuation of the pulmonary markings, and abnormal intensity of these markings was no longer seen as described during measles. The authors were under the impression that in 18 cases, pleural thickening, not present during measles, was seen at the site of the interlobar fissure between the upper and middle lobes of the right lung, or in some other portion of the pleura. The density of the hilum shadows appeared to be diminished when compared with films taken during measles. Most children re-

mained well after discharge from the hospital, and physical examination of the lungs gave normal results, even in patients who had been seriously ill while in the hospital.

F. B. MANDEVILLE, M.D.

Subacute Miliary Tuberculosis: Fatal Case in an Infant, with Roentgenologic Evidence of Healing. J. S. Uhr. *Am. Jour. Dis. Child.*, December, 1930, XL, 1269-1275.

Although miliary tuberculosis is nearly always fatal, the author has reviewed the literature and found reported roentgenologic and clinical observations which show that the disease is not always rapidly fatal and that healing and recovery may occur.

A case of miliary tuberculosis of the lungs in a child is presented by the author. Four chest roentgenograms taken during the course of the disease and showing extensive miliary infiltration of the lungs are included. From the mild course of the disease, as shown by the temperature curve, weight curve, absence of signs and symptoms, the five and one-half months' duration, and clearing up of the disease in the left lung, the author believes that he was dealing with the subacute rather than the acute form of miliary tuberculosis.

F. B. MANDEVILLE, M.D.

Tubercle Bacilli in Children with Erythema Nodosum: Demonstration by Gastric Lavage. Arvid Wallgren. *Am. Jour. Dis. Child.*, April, 1931, XLI, 816.

Children with erythema nodosum who give positive tuberculin reactions often excrete tubercle bacilli. These children seldom bring up sputum: the sputum and bronchial mucus that eventually are produced through irritation from the primary focus are swallowed. The tubercle bacilli must be looked for in the stomach. The author used Meunier's method and examined 40 children with erythema nodosum, all but three of whom reacted positively to tuberculin. Seventeen of the 37 who reacted positively to tuberculin, had tubercle bacilli in the gastric contents.

In the majority of cases with positive tuberculin reactions, there were more or less en-

larged hilar shadows noted on roentgenograms. Roentgenograms of three cases are included in this paper. In the author's opinion enlarged hilar shadows in the positive cases are of tuberculous etiology, and the children are really suffering from tuberculosis. He regards his work as an argument in favor of the tuberculous nature of erythema nodosum.

F. B. MANDEVILLE, M.D.

Chronic Hyperplastic Tuberculosis of the Colon. Samuel J. Goldfarb and Marcy L. Sussman. *Am. Jour. Roentgenol. and Rad. Ther.*, March, 1931, XXV, 324-329.

The hyperplastic form of tuberculosis of the colon is the least common type of tuberculous involvement and is in contrast to the commoner ulcerative type, which is apparently a primary lesion, often with no focus being demonstrable elsewhere in the body. This type of lesion may be found co-existent with typical tuberculous ulcers in the nearby gut. In some cases, it would appear that there is a non-specific ulcerative inflammation of the sub-mucosa, with abscesses, fistulae, and scar tissue, the tuberculosis being in the nature of accidental infection.

The cecum and lower portion of the ascending colon are the commonest seats, although more rarely the distal parts of the colon are involved. All three of the reported cases showed rather extensive involvement at the hepatic flexure region, but two showed also spastic deformities in the terminal ileum and cecum, such as occur characteristically in the ulcerative form of the disease. Two of the three cases were in association with active pulmonary involvement. The authors emphasize the dangers of attempting an etiologic diagnosis of stenosing lesions of the large intestine by roentgen appearances alone.

J. E. HABBE, M.D.

Phthisiogenesis and the Tuberculous "Frühinfiltrat." Hans Staub. *Schweiz. med. Wchnschr.*, Feb. 14, 1931, LXI, 157-161.

Clinical and pathologic anatomic observa-

tions demonstrate that the tuberculous "früh-infiltrat," like all the exudative forms of pulmonary tuberculosis, plays an important rôle in tuberculosis as a disease, whether it involves the infraclavicular region or the middle lung field. Apical tuberculosis, which is accompanied by definite symptoms, is equally important and deserves adequate recognition. Greater progress will be made in the early diagnosis of tuberculosis when both types of lesions are sought for.

H. C. OCHSNER, M.D.

TUBERCULOSIS (THERAPY)

Roentgen Therapy of Pulmonary Tuberculosis. Schulte-Tigges. *Schweiz. med. Wchnschr.*, April 25, 1931, LXI, 408.

Patients with productive fibroid tuberculosis, who are fever-free, or the cirrhotic cavernous types without elastic fibers in the sputum, can be irradiated. Treatment is contra-indicated in fresh infiltrative or active exudative processes.

H. C. OCHSNER, M.D.

Light Treatment in Tuberculosis of Lymph Glands. James W. Thornton. *United States Vet. Bureau Med. Bull.*, March, 1931, VII, 232-234.

The author describes seven cases of tuberculosis of the lymph glands treated by ultra-violet irradiation with apparent cures in the uncomplicated cases, and improvement in those cases associated with active pulmonary tuberculosis. As in the treatment of tuberculosis of other structures, any method of therapy to be successful must be continued over a considerable period of time. Foci of infection should be eradicated and the usual hygienic and dietetic régime adhered to. In uncomplicated cases exercise in the open, in the author's opinion, is of more value than rest in bed. Surgical removal of tuberculous glands is not always successful, as recurrences are frequent. While tuberculin and X-ray therapy have been recommended, these methods were not used in the treatment of the author's cases.

In tuberculosis of the lymph glands associated with active pulmonary lesions, the au-

thor, using the water-cooled lamp with the applicator almost in contact with the skin, applies ultra-violet rays locally to the skin over the affected glands. The initial exposure is of 30 seconds' duration and subsequent exposures are prolonged slightly on succeeding days until the maximum exposure of three minutes is reached. In uncomplicated gland involvement the same procedure is followed and in addition the air-cooled lamp is used for general irradiation, the lamp being placed 36 inches above the patient. The body is divided into zones and each zone is irradiated for three minutes. After several days, or when each zone has had at least one exposure, the time of exposure is gradually extended until a maximum of 20 minutes is reached. The author believes that, with suitable atmospheric conditions, heliotherapy is of still greater value.

J. N. ANÉ, M.D.

TUMORS (DIAGNOSIS)

Sacral Chordoma. James A. Dickson and Charles A. Lamb. *Ann. Surg.*, April, 1931, XCIII, 857-861.

Chordoma is a tumor arising from cellular remains of the notochord, occurring, therefore, along the spine, most frequently at its extremities. It is composed of epithelial tissue and is of endothelial origin. In 1929, reports of only 80 cases had appeared in all medical literature. The average age of onset is from 35 to 40 years, although cases have occurred as early as one and a half, and as late as 79 years. Spheno-occipital chordomas appear, on the average, ten years later than sacrococcygeal chordomas. Males are twice as prone as females to develop these tumors, probably because of the part trauma plays in their etiology. Chordomas are said to have been produced experimentally in rabbits by puncturing the body of a vertebra.

In the case reported, a man 41 years of age complained of pain in the lower part of his back for approximately ten months. Physical, laboratory, and X-ray examinations were negative, except for a tender area about the size of a half-dollar over the lower third of the

sacrum exactly in the mid-line. Rectal examination revealed a bulging area on the anterior surface of the sacrum in its lower third, which was tender and semi-fluctuant. At operation, a tumor mass, yellowish, soft, and very friable, which protruded from the posterior surface of the sacrum and extended to the anterior, was found. The pathologic diagnosis was sacral chordoma. The sacrum was radiated with 900 r-units. Later, on rectal examination, a mass was palpable which seemed to slowly increase in size. On second operation, a bluish-gray tumor mass apparently filled the entire sacral canal but no removal was attempted. Post-operative deep X-ray therapy of five doses of 160 r-units each was given. The tumor decreased in size and became harder and more calcified. The authors feel that the X-ray therapy has been successful in checking this tumor and that metastases are rare in this condition.

F. B. MANDEVILLE, M.D.

TUMORS (THERAPY)

A Tumor of the Mediastinum. R. S. Pentecost. *Can. Med. Assn. Jour.*, March, 1931, XXIV, 452.

This is a case report (by Dr. Pentecost, Dr. Macintyre, and Dr. Richards) of a patient with fibrosarcoma—a small tumor at the base of the epiglottis on the right side filling the pyriform fossa. The patient was referred in 1919 to Dr. Richards for X-ray treatment, which consisted of three series of high voltage X-rays, administered from three portals of entry, right lateral, left lateral, and a central, over the area of the larynx and neck. The technic consisted of 200,000 volts, with 0.5 mm. of copper filter, at a distance of 40 centimeters. The lesion literally melted away, and has never recurred. The patient was carefully followed for five years, and then reported as probably cured.

One month ago—twelve years after the original lesion—the patient returned to Dr. Pentecost, stating that for the past two months he had noticed a stiffness on the right side of his neck, with a feeling of tugging on the muscles, associated with slight coughing. There was no evidence of recurrence of the disease in the larynx or bronchial tree. X-ray

examination of the chest showed a diffuse growth about the size of an orange in the mediastinum. The patient was again referred to Dr. Richards for X-ray treatment.

Dr. Richards' comments on the case are as follows: "Whether this is a recurrence from the old primary lesion or the development of an entirely new sarcoma is at least debatable, and probably is a question which cannot be settled beyond the possibility of doubt. From a study of the films, I am inclined to believe that it is not a secondary in the strict sense of the word. Certainly the X-ray film is not the typical representation of secondary sarcoma, which is usually characterized by multiple lesions, embolic in character, scattered throughout the parenchyma of the lung. The present lesion is a localized one, arising from the hilum of the lung and spreading out from this in a somewhat fan-shaped manner. Its response to treatment may assist in a differential diagnosis. . . ."

Dr. Richards proceeds to discuss the various methods of treatment which might have been used in attacking the original tumor. The choice would be between radium, implanted in the form of needles or seeds, and external radiation in the form of high voltage rays or radium packs. He is strongly opposed to the implantation of radium seeds or needles in any sarcoma. Between radiation, externally by radium packs, and X-rays, there is little to choose.

L. J. CARTER, M.D.

Radiotherapy of Tumors. Schinz. *Schweiz. med. Wchnschr.*, April 25, 1931, LXI, 406.

The author discusses the underlying biologic principles of treatment. The results obtained are due to the cytolethal effect of the rays applied directly to the pathologic tissue. The action is unspecific, but elective action is the basis of scientific radiotherapy. He discusses the methods of radiotherapy including the single massive dose, the saturation method, and the fractional dosage. The basis of the newer forms of treatment is the greater toleration of the skin and subcutaneous tissues to

heavier radiation. A greater effect on pathologic tissues can, therefore, be secured. A detailed description is given of the symptomatic and histologic changes in the skin and mucous membrane following intensive fractional radiation.

The methods of treatment of epithelioma of the skin, esophagus, and tongue are given.

H. C. OCHSNER, M.D.

Effect of Irradiation upon a Malignant Thymic Tumor. Lloyd F. Craver. *Ann. Surg.*, January, 1931, XCIII, 391-397.

A single woman of thirty-nine years, complaining chiefly of cough and dyspnea and presenting on roentgenographic examination a large mediastinal mass believed to be a malignant thymic tumor, probably carcinoma, was treated with enormous doses of roentgen and radium irradiation. Treatment resulted in complete disappearance of all evidence of tumor at the primary site, and at autopsy a large cavity with healed walls was found in the right adrenal gland, and the aortic ab- Various small scattered metastases were found in the bronchial lymph nodes, the left lung, the right adrenal gland, and the aortic abdominal nodes, of which all except the bronchial nodes lay outside of the area that had been irradiated.

F. B. MANDEVILLE, M.D.

ULCER (ETIOLOGY)

Pepper and Gastric Ulcer. Editorial.

Jour. Am. Med. Assn., May 23, 1931, XCVI, 1798, 1799.

Although a century has elapsed since Cruveilhier, in 1829, first clearly described peptic ulcer, it would be rash to venture any conclusions at the present time regarding the precise etiology of this pathologic condition. At present, trauma is not generally believed to play a noteworthy part in the genesis of peptic ulcer, because, it is said, few of the persons who subject their stomachs to mechanical, chemical, or thermic insults suffer from ulcers. Traumatically produced, experimental ulcers heal readily, as a rule.

Bergsma, in Abyssinia, found an exceptionally high incidence of gastric and duodenal ulcer among the black people there in contrast with the comparative immunity of negroes in this country. Their diet included a sauce that was approximately 50 per cent cayenne pepper. From the time native babies are weaned, until old age, the diet contains monotonously the same dishes of sour bread, pepper sauce, mildly intoxicating drinks, beans (occasional), peas, and slightly cooked or raw meat. Disturbances of the stomach are common occurrences, and, at an early age, many individuals suffer from a contracted and scarred pylorus. The opportunity for continued chemical insult to the gastric mucosa seems to be afforded by the unusually high red pepper content of Abyssinian diet. If such peculiarities of dietary regimen are common in other countries, it would be of great interest to ascertain the incidence of gastric ulcer among their inhabitants.

C. G. SUTHERLAND, M.D.

CONTENTS OF ABSTRACTS IN THIS ISSUE, LISTED ALPHABETICALLY BY AUTHORS

BADGLEY, CARL E. (with DOUB, HOWARD P.).....	415	DAVIS, DAVID M. Resection of the Kidney.....	398
BARGEN, J. ARNOLD. Conditions Commonly Called Colitis.....	386	DAVIS, W. C. A Study of Intestinal Tubercu- losis.....	415
BARRINGER, B. S. Radium Therapy of Tumors of the Genito-urinary Tract.....	391	DAY, LOIS (with PHEMISTER, D. B., and BRUN- SCHWIG, ALEXANDER).....	372
BELL, GEORGE, and TEBBUTT, A. H. Syphilis of the Stomach Simulating Carcinoma.....	387	DELARIO, A. J. Paths of Absorption and Excre- tion of Sodium Tetraiodophenolphthalein.....	380
BERGSTRAND, H. A Peculiar, Apparently Hitherto Undescribed, Disease of the Long Bones of the Hand and Foot.....	367	DESJARDINS, ARTHUR U. The Status of Radi- ology.....	403
BICKENBACH and HAUPT. Radiation Therapy in Gynecology.....	411	DESPLATS (with CHERIGIE and LANGERON).....	365
BIVINGS, LEE. <i>Staphylococcus Albus</i> Septicemia with Osteomyelitis of the Pubic Bone.....	372	DESPLATS (with LANGERON, PAGET, and GUÉMÈRE).....	411
BLACKFORD, L. MINOR, and HOPPE, LEWIS D. Functionally Two-chambered Heart.....	394	DETERMANN, A. A Contribution to the Diag- nosis <i>in Vivo</i> of the <i>Situs Inversus</i> of the Abdominal Organs: Report of Three Cases..	362
BLAND, EDWARD F., and WHITE, PAUL D. (with SPRAGUE, HOWARD B.).....	395	DICKSON, JAMES A., and LAMB, CHARLES A. Sacral Chordoma.....	418
BLUMGART, H. L. Velocity of Blood Flow in Health and Disease: Velocity of Blood Flow in Man and its Relation to Other Measurements of Circulation.....	395	DIOCLES, LOUIS. Telestereoröntgenography.....	227
BODE, H.-G. Further Contributions to the His- tology of Sensitized Roentgen Irradiated Skin.....	412	DOUB, HOWARD P., and BADGLEY, CARL E. Tu- berculosis of the Intervertebral Articula- tions.....	415
BOEHM, GUNDO. Roentgen Diagraphic Exam- ination of Muscle Contraction.....	264	EDITORIAL, <i>Journal American Medical Associa- tion</i> . The Etiology of Hodgkin's Disease.....	398
BOLIN, ZERA E. (with REILLY, WILLIAM A.).....	414	Idem. Lead in the Growing Skeleton.....	365
BOROS, EDWIN. Fluoroscopy in Gastro-intes- tinal Diseases.....	384	Idem. Pepper and Gastric Ulcer.....	420
BOSTON, L. NAPOLEON. Gastric Hemorrhage Due to Familial Telangiectasis.....	385	EISENSTAEDT, J. S. Bladder Diverticula and Their Surgical Removal.....	364
BRITTON, JAMES A., and HEAD, JEROME R. Pneu- monoconiosis: The Delayed Development of Symptoms.....	379	EPSTEIN, STEPHAN. The Influence of Cones on the Dose.....	380
BROWN, A. LINCOLN. Post-operative Pulmonary Atelectasis.....	377	FARRAR, L. K. P. (with WARD, G. G.).....	375
BRUNSCHWIG, ALEXANDER, and DAY, LOIS (with PHEMISTER, D. B.).....	372	FARRELL, JAMES I. A Study of Vesicorenal Reflexes and of the Possibility of a Reno- renal Reflex.....	389
BRYANT, BEN L. How shall we Evaluate the Various Manifestations of Acute Mastoid- itis?.....	401	FISCHER, ALBERT, and HORWITZ, M. Multiplica- tion of the Effect of Very Small Radium Doses on Tissue Cells <i>in Vitro</i>	380
BUCHMAN, JOSEPH, and GITTLEMAN, ISAAC F. Inorganic Blood Chemistry in the Osteo- chondritides.....	366	FISH, GEORGE WINTHROP, and HALLOCK, LEONARD A. Calcification of Intrarenal Arteries, Giv- ing Roentgen Appearance of Calculi.....	390
BUCKLEY, R. C. (with FRIED, B. M.).....	373	FITZWILLIAMS, DUNCAN C. L. The Technic of Radium Therapy To-day.....	406
BURROWS, ARTHUR. Short Survey of Radium Treatment.....	404	FLIEDERBAUM, J. (with MESZ, N., and MARKUS- ZEWIEZ, R.).....	370
BURSTEIN, H. J. (with ROLNICK, HARRY C.).....	399	FLINN, FREDERICK B. Elimination of Radium Salts from the Human Body: Preliminary Report.....	405
CARROLL, GRAYSON (with LEWIS, BRANSFORD, and SCHATTYN, MARTYN).....	384	FORFOTA, ERICH. Joint and Bone Changes in Hemophilia.....	371
CHERIGIE, LANGERON, and DESPLATS. Blood Sugar Changes after Irradiation of the Suprarenal Regions.....	365	FRAIN (with CLERC and HARET).....	378
CHRISTIE, ARTHUR C. The Relation of Radi- ology to Other Branches of Medical Prac- tice.....	402	FRIED, B. M., and BUCKLEY, R. C. Primary Car- cinoma of the Lungs. IV.—Intracranial Metastases.....	373
CLERC, HARET, and FRAIN. Aneurysm of the Descending Aorta Simulating Lung Tumor..	378	FRITSCH, HANS. A Case of Arthropathy of the Shoulder with Syringomyelia.....	369
COLBY, FLETCHER H., and SMITH, GEORGE G. Car- cinoma of the Penis.....	373	FURRER, E. A Case of Pyloric Stenosis Due to Pancreatic Cysts.....	362
CRAVER, LLOYD F. Effect of Irradiation upon a Malignant Thymic Tumor.....	420	GALLY, LÉON (with JACQUET, PAUL).....	363
DALLY, WENDELL P. Chronic Bronchitis.....	378	GANZONI, M., and WIDMER, H. The Therapeutic Interruption of Pregnancy by Roentgen Rays	392
DANIELS, W. H. The Weak Foot.....	381	GARD, RAYMOND L. (with WAHL, H. R.).....	379
		GASTEIGER, H., and GRAUER, S. The Roentgen- ologic Demonstration of the Lacrimal Ducts by Means of a New Contrast Medium.....	380
		GITTLEMAN, ISAAC F. (with BUCHMAN, JOSEPH)	366

GLOOR, WALTHER, and ZUPPINGER, ADOLF. Blood Studies in Cases Receiving Protracted Fractional X-ray Treatment.....	365	JESIONEK, A. Davos.....	264
GODBEY, L. J. Electrocardiography as a Diagnostic Aid.....	395	JOHNER, THEOD. Studies on Fractures of the Upper Extremity of the Humerus.....	368
GOLDBLOOM, A. ALLEN (with HELD, I. W.).....	388	KAJDI, LASLO (with PARK, EDWARDS A., and JACKSON, DEBORAH).....	371
GOLDFARB, SAMUEL J., and SUSSMAN, MARCY L. Chronic Hyperplastic Tuberculosis of the Colon.....	417	KAMNIKER, HELLMUT. Our Experience with the Injection of "Beta Radiators" in Malignant Tumors.....	405
GRABERGER, GÖSTA. The Recognition of Accessory Centers of Ossification in the Transverse Processes of the Dorsal Vertebrae and the Persistence of These Centers in the Transverse Process of the First Dorsal.....	366	KIENBÖCK, ROBERT. A Case of Monoarticular Chondromatosis of the Skeleton.....	371
GRAUER, S. (with GASTEIGER, H.).....	380	KING, HOWARD, and HAMILTON, C. M. Leukoplakia Buccalis: A Study of Eighty Cases.....	411
GREBE. Roentgen Dosimetry.....	380	KIRKLAND, A. STANLEY. The Thymus.....	414
GRÜNTAL, J. Roentgenotherapy of Hypertrophy of the Prostate.....	410	KLÖVEKORN. X-ray Therapy of Inflammatory Conditions.....	408
GUÉMÈRE (with LANGERON, DESPLATS, and PAGET).....	411	KNIPPING, PAUL. The Physics and Technic of Cathode Rays.....	377
GUILBERT. The Treatment of Prostatic Hypertrophy by Deep X-ray Therapy.....	412	KOHN, JEROME L., and KOIRANSKY, HENRY. Roentgenographic Re-examination of the Chests of Children from Six to Ten Months after Measles.....	416
GUTMANN, RENÉ A. Radiologic Examination of the Stomach after Gastro-enterostomy.....	384	KOIRANSKY, HENRY (with KOHN, JEROME L.).....	416
HALLOCK, LEONARD A. (with FISH, GEORGE WINTHROP).....	390	LAMB, CHARLES A. (with DICKSON, JAMES A.).....	418
HAMILTON, C. M. (with KING, HOWARD).....	411	LANGERON (with CHERIGIE and DESPLATS).....	365
HARET (with CLERC and FRAIN).....	378	LANGERON, DESPLATS, PAGET, and GUÉMÈRE. Alterations in the Blood Calcium Level after Radiotherapy.....	411
HARMON, PAUL H., and McKENNA, HUGH. Primary Myelogenous Sarcoma Complicating Cystic Disease of the Humerus.....	366	LEHMANN, P. Curative Deep X-ray Therapy in Prostatic Hypertrophy.....	411
HAUPT (with BICKENBACH).....	411	LEONARD, MARION. Tuberculosis in the Mesenteric Lymph Nodes of Children.....	416
HEAD, JEROME R. (with BRITTON, JAMES A.).....	379	LEWIS, BRANSFORD, CARROLL, GRAYSON, and SCHATTYN, MARTYN. Uroselectan: A Radiological and Urological Study.....	384
HEGNER, C. F. Gaseous Pericholecystitis with Cholecystitis and Cholelithiasis.....	384	McKENNA, HUGH (with HARMON, PAUL H.).....	366
HEIN, GORDON E. Narrowing of the Aorta at its Isthmus.....	396	McLEAN, STAFFORD. III.—Correlation of the Roentgenologic Picture with the Gross and the Microscopic Examination of Pathologic Material in Congenital Osseous Syphilis.....	369
HELD, I. W., and GOLDBLOOM, A. ALLEN. The Treatment of Peptic Ulcer.....	388	Idem. IV.—The Correlation of the Clinical Picture with the Osseous Lesions of Congenital Syphilis as Shown by the X-rays.....	370
HERBST, ROBERT H. Recurrent Renal Calculus: Its Cause and Prevention.....	390	MARKUSZEWIEZ, R. (with FLIEDERBAUM, J., and MESZ, N.).....	370
HOFFMAN, J. M. Further Observations on the Use of Radium in the Control of Subcutaneous and Mucous Membrane Hemorrhage by Irradiation of the Spleen.....	408	MARTIUS. Roentgen Therapy of Uterine Myoma.....	391
HOFFMAN, WILLIAM J. New Technic and Instrument for Obtaining Biopsy Specimens.....	412	MATHEWS, R. F. Bladder Tumor: Survey of Fifty Cases.....	364
HOLMES, GEORGE W. Congenital Idiopathic Enlargement of the Heart.....	393	MATZ, PHILIP B. A Study of Bone Tumors in Ex-service Men.....	370
HOPPE, LEWIS D. (with BLACKFORD, L. MINOR).....	394	<i>Medical Journal of Australia.</i> Harmful Effects of Irradiation.....	316
HORWITZ, M. (with FISCHER, ALBERT).....	380	MEISELS, E. (with ST. LIEBHART).....	406
HUBENY, M. J. The Role of Roentgenology in Psychiatry.....	264	MENDONCA, JOSÉ. Diagnosis and Treatment of Acute Intestinal Obstruction.....	386
IVY, A. C. (with WALSH, E. L.).....	383	MESZ, N., FLIEDERBAUM, J., and MARKUSZEWIEZ, R. Two Cases of Achondroplasia.....	370
JACKSON, DEBORAH (with PARK, EDWARDS A., and KAJDI, LASLO).....	371	MEYER, HEINZ T. The Dependence of the Wave Length of Small Ionization Chambers ("Thimble Chambers").....	401
JACKSON, HENRY, JR., and MINOT, GEORGE R. The Medical Care of the Cancer Patient.....	376	MIBAYASHI, R. (with PLOTNIKOW, J.).....	381
JACOBSEN, VICTOR C. The Effects of High Voltage Cathode Rays on the Germinal Epithelium of the Rat.....	377	MILLER, G. H. (with SMITH, F. M.).....	385
JACQUET, PAUL, and GALLY, LÉON. The Radiological Diagnosis of Chronic Appendicitis.....	363	MILLER, JAMES, and YOUNG, D. H. Essential Hematuria in Relation to Pyelitis of the Calyx-papilla Angle.....	398
JANKER. Treatment of Surgical Tuberculosis with the X-ray.....	411	MINOT, GEORGE R. (with JACKSON, HENRY, JR.).....	376
JANSSON, GÖSTA. The Roentgen Diagnosis of Pericardial Diverticulum.....	394		

- MOPPETT, WARNFORD. The Differential Action of X-rays on Tissue Growth and Vitality (Part I)..... 408
- MÖRIKOFER, W. The Permeability of Cloth Material for the Spectrum of the Sun..... 258
- MYERS, J. ARTHUR (with WULFF, MARJORIE)..... 378
- NATHANSON, M. H. Electrocardiographic Study of Movements of the Heart with Change of Posture..... 396
- ORNDOFF, B. H. The Pathologic Cervix and its Treatment..... 393
- PAGET (with DESPLATS, GUÉMÈRE, and LANGERON)..... 411
- PALMIERI, G. G. Theoretic Foundations of a New Technic for Homogeneous Irradiation with Gamma Rays..... 405
- PANCOAST, HENRY K. Roentgenology of the Thymus in Infancy and Differential Diagnoses of Enlarged Thymus and its Treatment..... 413
- Idem. Safety for Radiologist and Patient in Diagnostic and Therapeutic Radiology..... 403
- PARK, EDWARDS A., JACKSON, DEBORAH, and KAJDI, LASLO. Shadows Produced by Lead in the X-ray Pictures of the Growing Skeleton..... 371
- PEABODY, C. W. Disruption of Pelvis, with Luxation of the Innominate Bone..... 369
- PENTECOST, R. S. A Tumor of the Mediastinum..... 419
- PFLIEDERER, A. Statistical Contribution to Carcinoma of the Uterus and its Treatment..... 376
- PHEMISTER, D. B., BRUNSCHWIG, ALEXANDER, and DAY, LOIS. Streptococcal Infections of the Epiphyses and Short Bones: Their Relation to Köhler's Disease of the Tarsal Navicular, Legg-Perthes' Disease, and Kienböck's Disease of the Lunatum..... 372
- PHILLIPS, RALPH. Histology of Buccal Carcinoma in Relation to Prognosis and Radio-sensitivity..... 374
- PICOT. Hydatid Cyst of the Lung..... 379
- PIERSON, J. W. Some Bone Changes Produced by Diseases of the Hematopoietic System..... 397
- PLOTNIKOW, J., and MIBAYASHI, R. Measurements of the Distribution of Heat Rays in Various Parts of the Animal Body by Means of the Photographic Method..... 381
- POHL, RUDOLF. Pathology of the Lower Colon..... 387
- POLGÁR, FRANZ. Flat Vertebrae (Platyspondylia: Presenile Osteoporosis)..... 367
- PUBLICATION COMMITTEE of the Canadian Medical Association Journal. The Present Status of Physiotherapy..... 402
- RAAP, GERARD. The Use of Radium in Benign Uterine Hemorrhage..... 408
- REILLY, WILLIAM A., and BOLIN, ZERA E. Acute Generalized Tuberculosis without Typical Tubercles..... 415
- REMY-ROUX. X-ray Therapy in Hemorrhages of the Menopause and Uterine Fibromas..... 393
- RENANDER, AXEL. Bone Metastasis in a Case of Hypertrophic Pulmonary Osteo-arthritis..... 368
- ROBB, JANE SANDS. Galvanometer Tracings Obtained in a Physico-chemical Schema Stimulating an Electrocardiogram, and the Influence of Membranes on These Records..... 396
- ROBERTSON, D. E. Sympathectomy for Megalocolon..... 385
- ROECK. Studies on the Stereoscopic Demonstration of the Gastro-intestinal Tract on the Basis of the Mucosa Technic..... 388
- ROGATZ, JULIAN L., and ROSENBERG, ALBERT. Acute Pyopneumothorax: A Case in an Infant Aged Nine Weeks..... 362
- ROLNICK, HARRY C., and BURSTEIN, H. J. Perinephritic Abscess..... 399
- ROSENBERG, ALBERT (with ROGATZ, JULIAN L.)..... 362
- ROTOLO, GIUSEPPE. Fractures of the Posterior Tubercle of the Astragalus and of the Os Trigonum: A Clinical and Anatomical Study..... 367
- ST. LIEBHART and MEISELS, E. So-called Late Reactions Following Radium Treatment in Gynecology..... 406
- SANDSTRÖM, CARL. An Improved Method for Oral Cholecystography..... 382
- SCHATTY, MARTYN (with CARROLL, GRAYSON, and LEWIS, BRANSFORD)..... 384
- SCHINZ. Radiotherapy of Tumors..... 419
- SCHULTE-TIGGES. Roentgen Therapy of Pulmonary Tuberculosis..... 418
- SCOTT, S. GILBERT. The Significance of the Radiological Renal Outline..... 399
- SILVER, PHILIP G. Ossification in a Laparotomy Wound..... 362
- SINGER, HARRY A. Leukoplakia of the Stomach: Report of a Case..... 386
- Idem. Primary Isolated Lymphogranulomatosis of the Stomach..... 397
- SMITH, F. M., and MILLER, G. H. The Reflex Influence of the Colon, Appendix, and Gall Bladder on the Stomach..... 385
- SMITH, GEORGE G. (with COLBY, FLETCHER H.)..... 373
- SPRAGUE, HOWARD B., BLAND, EDWARD F., and WHITE, PAUL D. Congenital Idiopathic Hypertrophy of the Heart: A Case with Unusual Family History..... 395
- STAUB, HANS. Phthisiogenesis and the Tuberculous "Frühinfiltrat"..... 417
- STEWART, J. EDGAR. Spondylolisthesis, with Special Reference to the Industrial Case..... 367
- SUETSUGU, J. Experimental Studies Concerning the Problem of Secondary Radium Rays..... 381
- SUSSMAN, MARCY L. (with GOLDFARB, SAMUEL J.)..... 417
- TEBBUTT, A. H. (with BELL, GEORGE)..... 387
- THOMS, HERBERT. The Diagnosis of Disproportion..... 392
- THORNTON, JAMES W. Light Treatment in Tuberculosis of Lymph Glands..... 418
- UHR, J. S. Subacute Miliary Tuberculosis: Fatal Case in an Infant, with Roentgenologic Evidence of Healing..... 417
- VANCE, CHARLES A. Mammary Cancer..... 373
- WAHL, H. R., and GARD, RAYMOND L. Aneurysm of the Pulmonary Artery..... 379
- WALLGREN, ARVID. Tubercle Bacilli in Children with Erythema Nodosum: Demonstration by Gastric Lavage..... 417
- WALSH, E. L., and IVY, A. C. Gall-Bladder Visualization and Jaundice..... 383

WARD, G. G., and FARRAR, L. K. P. Eleven Years' Experience with Radium Treatment of Carcinoma of the Cervix at the Woman's Hospital: Statistical Report.....	375	WIDMER, H. (with GANZONI, M.).....	392
WARD, ROY. Radium Treatment of Epitheliomas of the Skin.....	406	WILLAN, R. J. Radiography during Operation for Renal Calculus.....	390
WATSON, ERNEST M. Sinus Tract Carcinoma....	372	WOOD, FRANCIS CARTER. Protection of Patients and Operators from X-rays.....	403
WEED, WALTER A. Rational X-ray and Radium Therapy	402	Idem. Short Wave Length Radiation: Present Standards for Measuring Quantity and Quality	401
WEEKS, CARNES. Surgery of the Phrenic Nerve in Treatment of Intractable Hiccup.....	413	WORINGER, PIERRE. The Effect of Sunlight on the Immunizing Function of the Skin.....	412
WESTERBORN, ANDERS. The Importance of Roentgenographic Examinations in Acute Cases of Circumscribed or Diffuse Peritonitis	363	WULFF, MARJORIE, and MYERS, J. ARTHUR. Roentgenographic Examination of the Chest, with Case Reports.....	378
WHITE, PAUL D. (with SPRAGUE, HOWARD B., and BLAND, EDWARD F.).....	395	YOUNG, D. H. (with MILLER, JAMES).....	398
		ZUPPINGER, ADOLF (with GLOOR, WALTHER).....	365
